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ABSTRACT

This curriculum guide for students in grades K-4 is part of the My Health My World series which explores environmental health issues. Focusing on water, it includes (1) an activities guide for teachers which focuses on physical science, biology, and environment and health, presenting activity based lessons that entice students to discover concepts in science, mathematics, and health through hands-on activities; (2) a colorful illustrated storybook entitled, "Mystery of the Muddled Marsh," which teaches science and health concepts; (3) a reading activities booklet entitled, "The Reading Link," which presents reading activities to use with "Mystery of the Muddled Marsh"; and (4) "Explorations for Children and Adults," a mini-magazine full of information, activities, and fun things to do in class or at home related to water and health; water in the body; and how to make a difference. (SM)

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ED 447 123

Water and My World: My Health My World.

Barbara Tharp
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Nancy Moreno

Illustrated by T. Lewis

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MY HEALTH MY WORLD
WATER AND MY WORLD

ACTIVITIES

GUIDE FOR TEACHERS

SP039606

2A

The **My Health My World**® series for health and science education provides:

- Adventures in learning: Story Books
- Exciting hands-on: Activities Guide for Teachers
- Engaging health/science mini-magazine: Explorations for Children and Adults

The **My Health My World** series includes:

Mystery of the Muddled Marsh
Water and My World

ACTIVITIES
EXPLORATIONS
MYSTERY OF THE MUDDLED MARSH

Mr. Slaptail's Secret
My World Indoors

ACTIVITIES
EXPLORATIONS
Mr. Slaptail's Secret

WOW Publications

My Health My World®

ACTIVITIES

GUIDE FOR TEACHERS

Water and My World

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Baylor College of Medicine

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The activities described in this book are intended for school-age children under direct supervision of adults. The authors, Baylor College of Medicine and the publisher cannot be responsible for any accidents or injuries that may result from conduct of the activities, from not specifically following directions, or from ignoring cautions contained in the text.

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WOW! Publications

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Science and Health for Kids!

These My Health My World Activities are designed to be used with other components of the Water and My World unit:

My Health My World Adventures
Mystery of the Muddled Marsh

My Health My World Explorations
Water and My World

Acknowledgments

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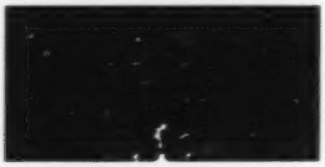
About My Health My World

The My Health My World Project's exciting *Activities, Explorations* and *Adventures* link students, teachers and parents to significant knowledge of the environment and its relationship to human health. Prepared by teams of educators, scientists and health specialists, each My Health My World unit focuses on a different aspect of environmental health science. The activity-based, discovery-oriented approach of the My Health My World materials is aligned with the *National Science Education Standards* and the *National Health Education Standards.*

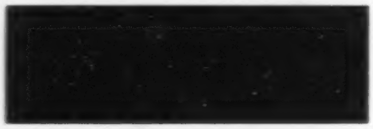
The three components of each My Health My World unit help students understand important health and environmental issues.

- *My Health My World Adventures* presents the escapades of Riff and Rosie in an illustrated storybook that also teaches science and health concepts.



- *My Health My World Explorations for Children and Adults* is a colorful mini-magazine full of information, activities and fun things to do in class or at home.

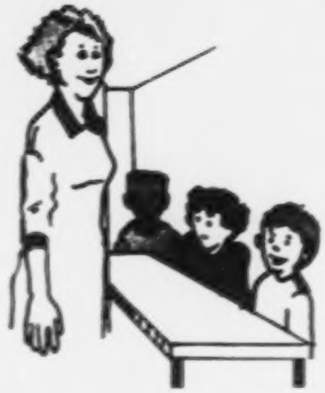
- *My Health My World Activities—Guide for Teachers* presents activity-based lessons that entice students to discover concepts in science, mathematics and health through hands-on activities.



My Health My World materials offer flexibility and versatility, and are adaptable to a variety of teaching and learning styles.

Where Do I Begin?

The *Adventures, Explorations* and *Activities* components of each My Health My World unit are designed to be used together to introduce and reinforce important concepts for students. To begin a My Health My World unit, some teachers prefer to generate students' interest by reading part or all of the *Adventures* story. Others use the cover of the *Explorations* mini-magazine as a way to create student enthusiasm and introduce the unit. Still others begin with the first discovery lesson in the *My Health My World Activities—Guide for Teachers.*



If this is your first My Health My World unit, you may want to use the pacing chart on the following page as a guide to integrating the three components of the unit into your schedule. When teaching My Health My World for 45 to 60 minutes daily, most teachers will complete an entire My Health My World unit with their students in two to three weeks. If you use My Health My World every other day or once per week, one unit will take from three to nine weeks to teach, depending on the amount of time you spend on each session.

The *My Health My World Activities—Guide for Teachers* provides background information for you, the teacher, at the beginning of each activity. In addition, a listing of required materials, estimates of time needed to conduct activities, and links to other components of the unit are given as aids for planning. Questioning strategies, follow-up activities and appropriate treatments for student-generated data also are provided. Student pages are provided in English and in Spanish. The final activity in each *My Health My World Activities—Guide for Teachers* is appropriate for assessing student mastery of concepts.

Using Cooperative Groups in the Classroom

Cooperative learning is a systematic way for students to work together in groups of two to four. It provides an organized setting for group interaction and enables students to share ideas and to learn from one another. Through such interactions, students are more likely to take responsibility for their own learning. The use of cooperative groups provides necessary support for reluctant learners, models community settings where cooperation is necessary, and enables the teacher to conduct hands-on investigations with fewer materials.

Organization is essential for cooperative learning to occur in a hands-on science classroom. There are materials to be managed, processes to be performed, results to be recorded and clean-up procedures to be followed. When students are "doing" science, each student must have a specific role, or chaos may follow.

The Teaming Up! model* provides an efficient system. Four "jobs" are delineated: Principal Investigator, Materials Manager, Reporter and Maintenance Director. Each job entails specific responsibilities. Students wear job badges that describe their duties. Tasks are rotated within each group for different activities, so that each student has an opportunity to experience all roles. Teachers even may want to make class charts to coordinate job assignments within groups.

Once a cooperative model for learning has been established in the classroom, students are able to conduct science activities in an organized and effective manner. All students are aware of their responsibilities and are able to contribute to successful group efforts.

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* Jones, R. M. 1990. Teaming Up! LaPorte, Texas: ITGROUP.

Sample Sequence of Activities, Adventures and Explorations

The components of this My Health My World unit can be used together in many ways. If you have never used these materials before, the following outline might help you to coordinate the activities described in this book with the unit's *Adventures* story (*Mystery of the Muddled Marsh*) and *Explorations* mini-magazine (*Water and My World*).

Similar information also is provided for you in the "Links" section of each activity in this book.

Activity	Concepts	Class Periods to Complete Activity	Links to Other Components of Unit	
			Adventures: *Mystery of the Muddled Marsh*	**Explorations: *Water and My World***
1. **Do Liquids Behave?**	Water molecules stick together.	2	Read pages 1–4.	Poem *Falling Water* on page 3.
2. **Disappearing Act**	Some things dissolve in water.	1	Read pages 5–9.	*The Great Dissolver* on page 4.
3. **Three States of Water**	Water circulates among three states (solid, liquid, gas) in the water cycle.	2	Read pages 10–13.	*What Am I?* on page 5.
4. **Using Water Every Day**	Water has many uses.	2	Read pages 14–17.	Cover Activity; *Not Such a New Issue* on page 5.
5. **All Dried Up**	Water is in all foods.	1 or 2	Read pages 18–22.	*Water in Your Body*, back page.
6. **Water Any Body?**	Our bodies take in and give off water.	1	Read pages 23–25.	Intestine puzzle and *Try This* on page 4.
7. **Pollution Dilution**	Very tiny amounts of substances can be dissolved in water.	1	Read pages 26–31.	*Let's Talk About Water and Health* on pages 2–3.
8. **Separating Solutions**	Many different substances can be dissolved in water at the same time.	1	Revisit Science Boxes on pages 17 and 24.	*Riff and Rosie Talk to Ms. Linda Holman* on page 7.
9. **Make a Muddled Marsh**	Non-point source pollution is a threat to water resources.	3	Revisit Science Boxes on pages 10 and 21.	*We Can Make a Difference!* on page 6.
10. **Water—Got to Have It**	Summary and assessment activity.	1	Revisit Science Boxes on pages 2, 3 and 7.	*Tips for Healthy Living* on page 3; Cover Activity.

Using This Unit with Students at the K–1 Level

Some modifications for younger students are appropriate. To begin the unit, introduce students to the main characters in the My Health My World Adventures storybook. Then read the beginning of the story to the students. You could follow this by demonstrating the paper-folding activity in the back of the storybook. You may want to let the students make their own, with a few helping hands, or make them for the entire group ahead of time.

Each story session should cover only about five pages of the book, accompanied by science concepts. The mini-magazine should be incorporated as appropriate. Many of the hands-on activities in this guide are more appropriately conducted for younger children as teacher demonstrations, unless you have several helpers to facilitate the activities.

Materials

You will need the following materials to teach this unit with 24 students working in six cooperative groups.

Equipment and Materials

Bracketed numbers correspond to the activities in which the item is used.

36	250-mL beakers or 8 oz clear plastic cups calibrated in milliliters [2, 5, 6, 7, 8]
36	disposable spoons or coffee stirrers [2]
12–24	eyedroppers [1, 7]
12	containers, minimum capacity of 3 liters [6]
6–12	hand lenses or magnifiers [1, 5]
6–24	scissors [8]
6–24	rulers [8]
6	balances [5]
6	chemistry trays or plastic egg cartons (halved) or sets of 6 small cups [7]
6	funnels [9]
6	juicers (see Set-up on page 19 for instructions on making your own) [5]
6	knives, plastic serrated [5]
6	rubber bands (large) or pieces of elastic [3]
6	shoeboxes or rectangular plastic boxes with clear covers [3]
	lamp with incandescent bulb if sunny window is not available [3]

Consumable Supplies

Bracketed numbers correspond to the activities in which the item is used.

24	sheets of drawing paper (1 sheet per student) or large sheet of butcher paper (1 per group) [10]
24	toothpicks [1]
12	sheets of cm graph paper [1]
12	cups of sand [3]
6–12	coffee filters, round basket-type [8]
6	apples [5]
6	oranges [5]
6	small containers of each of the following: salt, sugar, flour, salad oil, diluted food coloring and ground coffee (not instant) [2]
6	small containers of mineral or salad oil [1]
6	plastic soda bottles, 2-liter size [5, 9]
6	drinking straws or 2 sheets of paper toweling [5]
6	small containers of water [1]
1	set of food coloring, red, blue and green [1, 7, 8]
	crayons, pencils, paints, etc. [10]
	small container of fish food [9]
	small container of "plant food" [9]
	foil or plastic wrap to cover bottoms of shoeboxes [3]
	ice cubes [3]
	roll of paper towels [1]
	plastic wrap to cover tops of shoeboxes [3]
	water (1 liter) from a pond, ditch or stream, hay infusion kit, or dried grass or hay and tap water without chlorine [9]
	wax paper [1]

Physical Science Basics

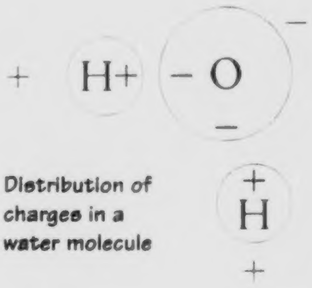
Water

Over 70% of the surface of the Earth is covered by water. This amazing substance is essential for all life on our planet and helps maintain our climate. Water has several unique properties that distinguish it from most other substances.

- **Water has both a high boiling point (100°C; 212°F) and a low freezing point (0°C; 32°F).** Consequently, it can be found naturally as a solid (ice or snow), a liquid (liquid water) and a gas (steam or water vapor), at any given time on our planet.
- **Liquid water changes temperature very slowly.** This helps animals maintain the temperatures of their bodies. It also keeps large areas of water from warming or cooling rapidly and, consequently, helps regulate Earth's climate.
- **Liquid water is an excellent solvent.** This makes water particularly valuable to living organisms. All of the thousands of chemical processes inside cells take place in water. Water also is used to carry dissolved nutrients throughout the bodies of living organisms and to transport wastes. Unfortunately, the same characteristics make liquid water easy to pollute, because so many different chemicals can be dissolved in it.
- **Molecules in liquid water are attracted to one another** and, as a result, "stick" very closely together. This accounts for water's ability to form rounded droplets and to rise within a thin, hollow tube. This characteristic is important for plants which conduct water and nutrients through very narrow tubes that reach from the roots to the branches and leaves.
- **Liquid water expands when it becomes a solid (ice).** Most substances take up less space when they are transformed from a liquid to a solid. Water, on the other hand, actually takes up more space as a solid because the molecules in ice crystals are farther apart than they are in liquid water. Because it is less dense, ice floats on top of liquid water.
- **Water is colorless and allows light to shine through it.** Plants can grow underwater because water is transparent to the wavelengths of light needed for photosynthesis.

Most of these properties are related to the structure of the water molecule. Each water molecule consists of two hydrogen atoms and one oxygen atom. As with all molecules of this type, the oxygen atom and the hydrogen atoms share electrons. However, the electrons are not shared equally—they are pulled toward the oxygen side of the molecule. which ends up with a slight negative charge. Correspondingly, the hydrogen side of the molecule ends up with a slight positive charge. This separation of positive and negative charges (polarity) makes each water molecule act like a tiny magnet—capable of clinging to other water molecules and to any other particle or surface that is electrically charged.

Earth sometimes is called the blue planet because of the way it appears from outer space. All of the water on the Earth's surface makes it look blue.



Distribution of charges in a water molecule

1. Do Liquids Behave?

Background

Water molecules are attracted to each other because, in many ways, they act like tiny magnets. Each molecule in liquid water has a positive end and a negative end. The forces of attraction between the opposite charges hold the molecules together very tightly. Attraction among molecules of the same kind is called cohesion.

The forces of attraction among the molecules in most liquids are not as strong as the ones that occur among water molecules. This "stickiness" of water accounts for much of its behavior, including the formation of rounded droplets and its ability to creep upwards inside a narrow tube (capillary action).

This activity lets students discover some of the unique qualities of water and compare and contrast them with another liquid (mineral or salad oil) that behaves differently.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, pages 1–4
Make A Paper Boat, page 32

Explorations:
Poem *Falling Water*, page 3

Set-up

This activity can be done in one or two class periods. Students should work in teams of two in order to share materials. Plastic or colored wooden toothpicks work best for this activity. If you prefer to use plain, wooden toothpicks, soak them in a glass of water for an hour or so before using them. (Dry, unvarnished toothpicks will absorb the water droplets.) Do not substitute plastic wrap for waxed paper in this activity. (Static charge on the sheets of plastic wrap may affect behavior of the drops of water.) Resealable plastic bags may be substituted for the wax paper.

Procedure

First session: Examining Liquid 1

1. Demonstrate the use of an eyedropper by placing several drops of Liquid 1 (water) on the overhead.
2. Ask students to describe the drops that are projected. Explain that they will be examining drops of two different liquids at their own working areas.
3. Have a member of each team collect materials, including 1 sheet of graph paper, 1 sheet of wax paper, 1 eyedropper, 2 toothpicks, Liquids 1 and 2, and a dropper container of food coloring. Each

Concepts

Water is a unique liquid. Many of water's unique properties are caused by its polarity.

OVERVIEW

Students will explore some of the physical properties of water and oil.

Science, Health + Math SKILLS

Predicting
Making and recording observations
Drawing conclusions

TIME

Preparation: 10 minutes
Class: One or two 30 minute sessions

MATERIALS

Copies of "Do Your Liquids Behave?" (1 per student or per team), page 4

Each team of two students will need:
- hand lens or magnifier
- paper towel
- wax paper
- 2 eyedroppers
- sheet cm graph paper
- small container of water (Liquid 1)
- small container of mineral or salad oil (Liquid 2)
- 2 toothpicks
- dropper container of food coloring
- crayons, colored pencils or markers in the same color as the food coloring

pair of students should prepare a working surface by placing the wax paper over the graph paper.

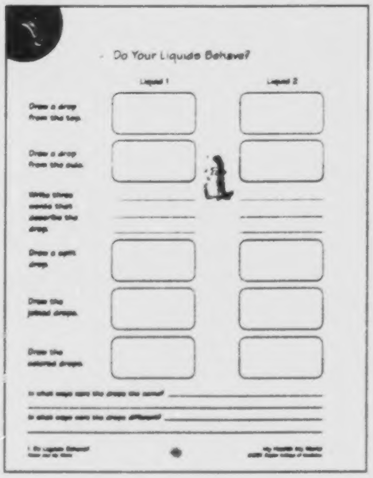
4. Have the students practice making equal-size drops of Liquid 1, using the graph paper as an approximate guide to size, and examine the drops with their hand lenses.
5. Ask the students to draw one of the drops from the side and top views on their "Do Your Liquids Behave?" sheets and describe the drop using at least three descriptive words.
6. Next, ask the students to try to split one drop into smaller drops using a toothpick. They should draw the results on their sheets.
7. Now, have the students try to move two drops together and discover what happens. Have them draw the new drop that is formed when the two smaller drops come in contact.
8. After forming the new larger drop, students should dip their toothpicks into a drop of food coloring and mix it into the new drop. Have them draw the drop again and color it appropriately.
9. Before continuing, have the students dry their work areas with paper towels. Each student should place a new drop of water (Liquid 1) near the top of the wax paper.
10. Challenge the students to use their toothpicks to push their complete drops (size of their choice) as quickly as possible from the top of the wax paper to the bottom. Ask, *Were all the drops that you raced the same size? What size drop moves faster? Is there anything else that affects how fast a drop can be pushed?*

Second session: Examining Liquid 2

1. Have students repeat the preceding exploration using Liquid 2 (oil) and record their results in the second column on their sheet.
2. Afterwards, have the students think about and answer the comparison questions at the bottom of the student page. Discuss the observations with the class. *Did the two liquids behave in the same way? Which one made round drops? Was it possible to race drops of Liquid 2 over the wax paper? Why or why not?* OR ask, *How were the drops alike? How were the drops different?*

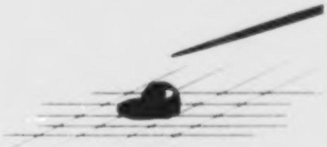
Variations

- Encourage students to consider other variables. For instance: What happens when they mix Liquid 1 and Liquid 2 together? What happens if food coloring is added to the mixture?
- Have students add a drop of liquid soap or detergent to a drop of water and observe what happens. (The soap decreases the attraction among water molecules, and thus makes the drop spread out.)
- Make paper boats as Riff and Rosie do (*Mystery of the Muddled Marsh*, page 32). Use this as part of a mathematics lesson or to further explore the properties of water by floating the boats.


Do Your Liquids Behave?

Liquid 1

Liquid 2


Students will observe and compare the characteristics of drops of water and oil.

Do Your Liquids Behave?

	Liquid 1	Liquid 2
Draw a drop from the top.		
Draw a drop from the side.		
Write three words that describe the drop.		
Draw a split drop.		
Draw the joined drops.		
Draw the colored drops.		

In what ways were the drops the same? ____________________

In what ways were the drops different? ____________________

¿Como Se Comportan Los Líquidos?

	Líquido 1	Líquido 2
Dibuja una gota vista desde arriba.		
Dibuja una gota vista desde un lado.		
Escribe tres palabras que describan una gota.		
Dibuja la gota partida.		
Dibuja las gotas unidas.		
Dibuja las gotas con colores.		

¿En que se parecen las gotas? ____________________

____

¿En que se diferencian las gotas? ____________________

____

2. Disappearing Act

Background

One of the most important properties of liquid water is its ability to dissolve many different substances. The same forces of attraction among molecules that account for the "stickiness" of water also act as tiny magnets that pull certain types of molecules (such as table salt) apart or allow some substances (alcohol, for example) to mix uniformly with water. In general, molecules that have a positive end and a negative end, or that can separate into components that have positive and negative charges, will dissolve in water. Molecules without these characteristics, such as oils, will not dissolve in water.

The uniform mixture that results when one substance (such as table salt) is dissolved completely in another (such as water) is called a solution. Many common items are solutions. Household vinegar, for example, is a solution of acetic acid in water. Rainwater is a solution of many substances that are picked up by water as it travels through the atmosphere to the surface of the Earth.

The reactions that take place inside living cells depend on the presence of water. Likewise, organisms require water outside of cells to carry nutrients and other substances from place to place, and to take waste products away. In our daily lives, we take advantage of water's abilities to dissolve and remove unwanted substances by using it for cleaning and rinsing.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, pages 5–9
Explorations:
The Great Dissolver, page 4

Set-up

Before beginning, prepare a dilute solution of food coloring by adding several drops of any color to a glass of water. Use this for one of the substances to be tested.

This activity should be conducted with the students working in groups of 2–4. Set all the materials in a central area for the Materials Managers.

Procedure

1. Each group of students should have a copy of the "Disappearing Act—My Observations" sheet, 6 clear cups of water, 6 spoons or coffee stirrers, and a small cup or bottle cap of each of the following: salt, sugar, flour or cornstarch, salad oil, diluted food coloring and ground coffee.
2. Show the students a clear glass of water. Ask, *Have you ever*

CONCEPTS

Some liquids and solids will dissolve in water.
Substances dissolved in water sometimes are invisible.

OVERVIEW

Students will investigate whether several common substances are soluble in water.

SCIENCE HEALTH MATH SKILLS

Predicting
Making and recording observations
Reaching conclusions

TIME

Preparation: 10 minutes
Class: 30 minutes

MATERIALS

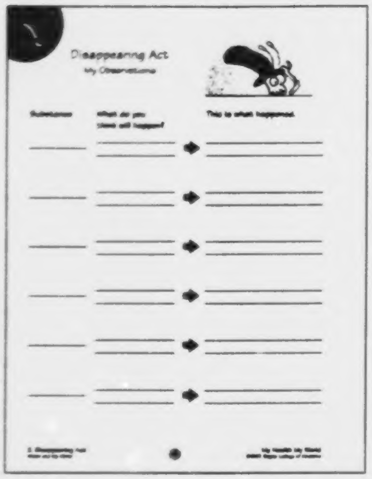
Each group will need:
- copy of "Disappearing Act—My Observations" sheet
- 6 beakers or clear plastic cups of water
- 6 spoons or coffee stirrers
- small cup or bottle cap of each of the following: salt, sugar, flour, salad oil, diluted food coloring and ground coffee (not instant)

When one substance becomes dissolved in another, the atoms or molecules of each substance are mixed evenly together.

mixed or stirred something into a glass of water? What happened? Do you think that everything can mix with water? Tell students that they will observe what happens when they mix different things with water.

3. Before they actually begin, have students predict what will happen when they mix each of the substances with water. Have them write their predictions on the "My Observations" sheet.
4. Guide the students as they conduct their tests, one substance at a time. First, they should observe the substance that they are about to add to the water. *Is it a solid or a liquid?* Next, they should empty the contents of the cup or bottle cap into one of the cups of water and stir for several seconds. Finally, they should note whether the substance disappeared. Older students should record their observations in the appropriate spaces on the "Disappearing Act—My Observations" sheet. Have younger students draw pictures of their results or report their results to you. You may want to fill in the names of the substances being tested before making copies of observation sheets for students.
5. When the students have completed their investigations, discuss their observations with them. Project a transparent copy of the "My Observations" sheet on an overhead projector or draw a similar table on the board, and call on each of the groups to provide their observations for one of the substances.

   Expect the following results: salt, sugar and food coloring will mix uniformly (dissolve) with water or disappear; flour or cornstarch, oil and ground coffee will not mix completely. Students may report different results depending on whether they stirred the mixtures well. Discuss any differences in the results obtained by the groups.
6. Conclude with a discussion of the observations. Ask, *Which things disappeared into the water when you stirred? Do you think that they* (salt or sugar) *are still there? How could you figure this out?* Ask about the other substances. *Did they mix completely with the water? Can you think of a way to separate any of these things from the water?*
7. Extend the discussion to include students' ideas about how the role of water as a "dissolver" is useful in our everyday lives. After students have discussed this idea, have students think about what happens to the things that remain in water after it is used for cleaning, rinsing, etc. Ask for suggestions about how this might contribute to water pollution. Also ask, *How many substances did you dissolve in* (or add to) *water today?*



Substances like alcohol that dissolve easily in water are called hydrophilic, from the Greek words hydro- (water) and -philos (loving).

Variations

- Create filtering cups by punching holes in the bottoms of disposable cups. Line the cups with coffee filters or paper towels and have the groups pour the contents of each of the cups used for the activity through the filtering cups and report on the results.
- Have students mix a spoonful of soil into a cup of water and report their observations.

Disappearing Act

My Observations

Substance	What do you think will happen?		This is what happened.
		➡	
		➡	
		➡	
		➡	
		➡	
		➡	

Acto de Desaparición

Mis Observaciones

Sustancia	¿Qué piensas que va a pasar?		Esto es lo que pasó.
		➡	
		➡	
		➡	
		➡	
		➡	
		➡	

3. Three States of Water

Background

Water is one of the few substances that can be found in all three states—solid, liquid and gas—at any given time somewhere on Earth. For example, snow and ice always are present at the poles, as well as on the tops of high mountains. Liquid water is abundant in many places on Earth, including lakes, rivers, oceans, and underground. Water vapor, the gas phase of water, usually makes up a tiny component of the air around us (up to 5%), and can be observed as steam when liquid water is heated.

When talking about this important resource, we usually think of liquid water. However, if water were not continuously cycling among its three states, the world's stores of freshwater quickly would become depleted or too polluted to use. Fortunately, our supply of freshwater continually is collected, purified and redistributed as part of the water cycle. Also known as the hydrologic cycle, this continuous process replenishes our water sources through precipitation (rain, mist, snow and sleet, for example). Some of the water from precipitation soaks into the ground. The rest runs off into streams, lakes and the oceans. Heat from the sun causes water to evaporate from the land and from bodies of water. Water vapor collects in the atmosphere until there is too much for the air to hold in clouds, leading once again to rain or snow.

This activity allows students to explore properties of water that are important to the water cycle.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:

Mystery of the Muddled Marsh, pages 10–13
Science Box, page 2

Explorations:

What Am I?, page 5

Set-up

Conduct this activity with the students in groups of 2–4. Place a container of sand in a central area, so that groups may measure out the quantities they will need.

Procedure

First session: Making the model

1. If using shoeboxes, have each group line the inside of their box by pressing a single sheet of foil or plastic wrap along the bottom and up the sides of the box.
2. Direct the groups to take turns measuring out two cups of sand and placing it in a pile at one end of their boxes.

CONCEPTS

Water can be found naturally as a solid, a liquid and a gas.
Water circulates among these three states in the water cycle.

OVERVIEW

Students will create a simple model of the water cycle.

SCIENCE, HEALTH + MATH SKILLS

Predicting
Measuring
Making and recording observations
Drawing conclusions

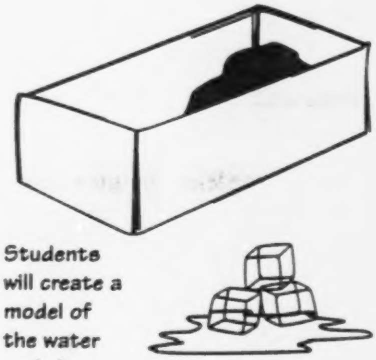
TIME

Preparation: 10 minutes
Class: 30 minutes to set up; 30 minutes to observe and draw conclusions

MATERIALS

copy or an overhead transparency of the "Water Cycle," page 13
shoeboxes or rectangular plastic boxes with clear covers (1 per group)
foil or plastic wrap to cover bottoms of shoeboxes (if not using plastic boxes)
plastic wrap to cover top of shoeboxes (if not using plastic boxes)
large rubber bands or pieces of elastic (if not using plastic boxes)
sand (2 cups per group)
lamp with incandescent bulb if sunny window is not available
ice cubes

3. Have the students smooth the sand to create a hill at one end of the box, gradually sloping it toward the other end. This will form the land in the model.
4. Have each group place 10 ice cubes on top of the "land" in the box. The ice cubes will be "snow" and "ice" in the model.
5. Help the groups cover each box with another sheet of clear plastic wrap and secure it with a large rubber band. (If using plastic storage boxes, cover securely.)
6. Discuss the models with the class. Ask, *Which part of the box and its contents could represent land? Which part could represent snow on the tops of mountains or ice in the winter? Do you think a lake could form? Where might it be?* You may want to ask students to draw a "side view" of what they think the box will look like at the end of the day.
7. Place the boxes in a sunny window or a under a lamp with an incandescent (not fluorescent) light bulb. If possible, have the students observe their boxes at intervals throughout the day. Otherwise, have them observe the boxes within the next day or so.



Students will create a model of the water cycle by placing ice cubes over a mound of sand within a closed container.

Second session: Looking at results

1. Have the students observe their boxes without removing the plastic coverings. Ask them to note the changes that have occurred inside the boxes. *What happened to the ice cubes? What else is different about the inside of the box?* In most cases, at least a few drops of water will have condensed on the inside of the covering. Ask, *Where did the drops of water come from?*
2. Help students understand that all three states of water have been present in their shoeboxes. Review the different states in which water can be found—ice or snow (solid), liquid water and water vapor. Breathe on a mirror or piece of glass to show students how water vapor condenses on a surface OR boil a small container of water, so that students may observe the cloud of steam. Hold a glass or mirror above the steam.
3. Let the students remove the covers from the boxes. Ask them to observe the surface of the sand. *Has the surface of the sand changed? In what ways?*
4. Talk about where the water in the box has gone. *Where was all of the water in the box when we started? Where is the water now?* If students have not noticed that the surface of the sand is wet, point out that some of the water has run into the bottom of the box to make a "lake" and some has soaked into the sand. Help students understand that the same processes take place outside when it rains and snows.
5. Challenge students to think about what would happen if other substances (for example, chemicals, oils, etc.) also were present either on the surface or mixed into the sand.
6. Give each student a copy of the "Water Cycle" page, or project an overhead transparency of the page. Have students identify the

The Water Cycle

forms in which water is present in the diagram (for example, snow on mountain tops is a "solid" form of water, and water evaporating from the ocean represents water in a "gas" phase). With very young students, direct each child to place a sticker everywhere on the page where he or she can find some form of water.

Variations

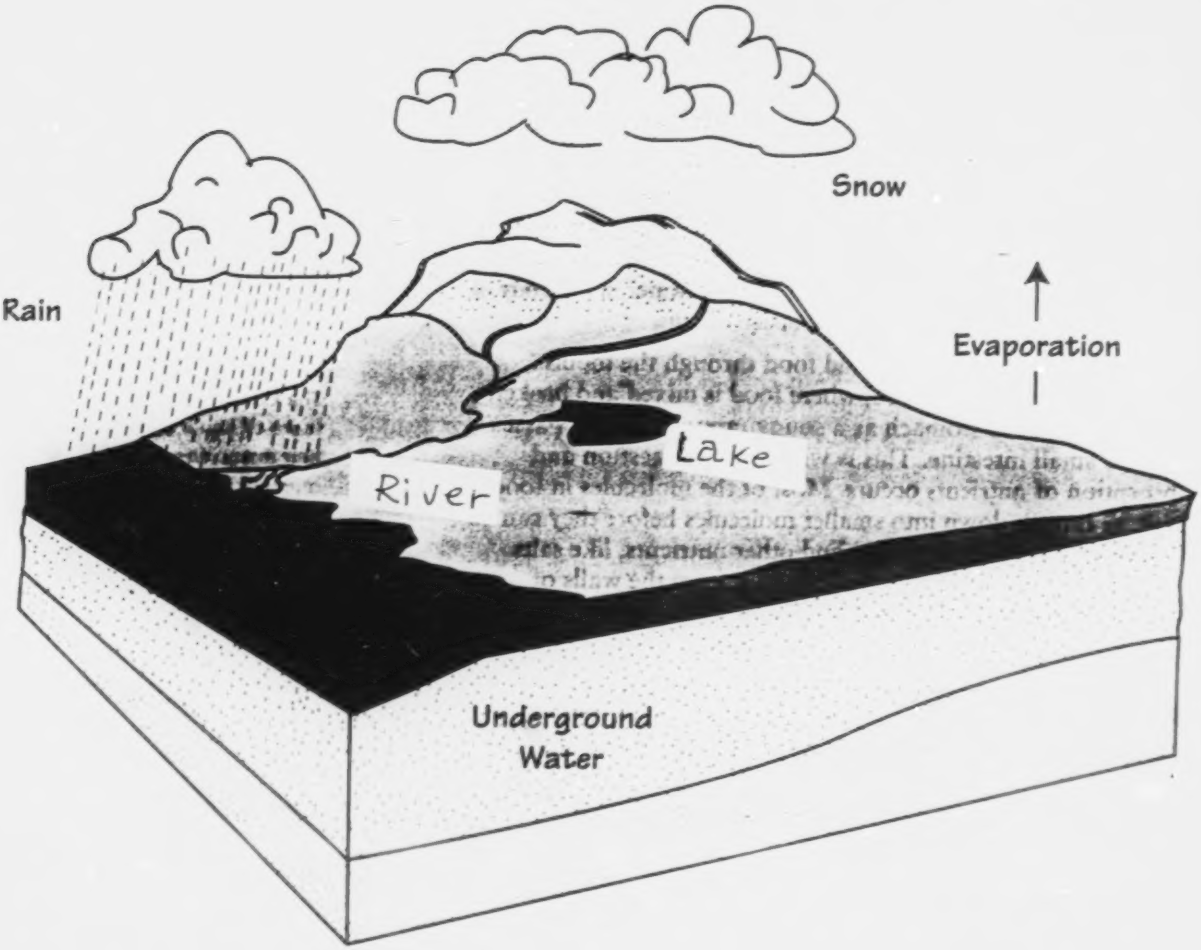
- Have students design experiments to test what happens to chemicals in soil by placing drops of food coloring on the sand in the shoeboxes before adding the ice cubes. Ask them to note where the colors end up in the system.

Questions for Students to Think About

- *What would happen to the water on our planet if the recycling of water through the atmosphere suddenly stopped? What does this teach us about using this resource wisely?*
- When water evaporates, any dissolved substances are left behind. *What do you think eventually happens to manufactured chemicals that have been mixed into water? How could this be avoided?*

Most snowflakes are in the shape of a hexagon. This six-sided arrangement actually reflects the arrangement of water molecules inside the crystals of snow. Each snowflake contains around 10^{16} water molecules.

The Water Cycle


Snow
Rain
Evaporation
Lake
River
Underground Water

Biology Basics

Water in Our Bodies

Every living organism, whether it consists of one cell or many, relies on water for the transport of needed nutrients and, in most cases, oxygen. Water also is used to carry waste products away. Even the countless reactions that happen inside cells must take place in a water-based solution.

Organisms consisting of one to just a few cells interact directly with their environments. Procuring raw materials and dumping wastes are relatively simple processes because each cell is in contact with the outside (usually water-containing) environment. More complex organisms, however, must find ways to maintain a constant internal fluid environment. They also must provide cells with the materials that they need and remove waste products.

In vertebrate animals, nutrients, gases and wastes are carried throughout the body by the circulatory system—which consists of a heart and numerous blood vessels. Water is a significant component of blood and also is the base for the solutions that surround cells throughout the body. In fact, about 50% of the water in the body of a complex animal is found in fluids outside of cells.

Vertebrates take in water and food through the mouth. Materials reach the stomach, where food is mixed and broken up. Food exits the stomach as a soupy mixture, which passes into the small intestine. This is where most digestion and absorption of nutrients occurs. Most of the molecules in food must be broken down into smaller molecules before they can be absorbed into the body. These and other nutrients, like salts and minerals, pass through the cells that form the walls of the intestine into the bloodstream. The presence of water is essential for the transport of nutrients released during digestion.

Before passing into the rest of the body, blood from the intestine and stomach is transported to the liver. This organ is responsible for maintaining relatively constant concentrations of nutrients (sugars and amino acids—the building blocks of proteins) in the bloodstream. Materials that have passed through the small intestine enter the large intestine. One of the chief functions of the large intestine is to reabsorb much of the water used during the digestive process.

The removal of wastes from cells also depends on water. Cells release waste products into the blood, which carries them to the kidneys. These organs, located near the lower back of the body, remove potentially toxic wastes from the blood. The kidneys use very little water in this process. Waste materials are concentrated as urine, which is stored in the bladder before being eliminated. The kidneys also control the relative amounts of water that are kept within the body and/or released in urine.

The small intestine of an adult person is about 23 feet long and about an inch in diameter.

The large intestine is about 5 feet long and about 3 inches in diameter.

The kidneys filter over 170 liters of liquid each day. Imagine how many glasses of water this represents!

Water loss always is a threat to the survival of living organisms. Water can be lost by evaporation from surfaces involved in breathing (inside the lungs, for example), by evaporation from other surfaces (such as through perspiration), and by elimination (both in urine and in feces). Water that is lost must be replaced. Additional water can come from food, from drinking liquids and as a byproduct of energy-releasing reactions inside cells.

4. Using Water Everyday

Background

Each of us uses water in many ways each day. Some of these uses are essential for life. For example, it is recommended that we drink 8 to 10 glasses of water each day in order to stay healthy. This water can come from liquids that we drink or from foods that we eat. We also use water to wash dishes and food items, to remove microorganisms that can cause illnesses. We prevent some kinds of diseases when we use water for bathing and for brushing teeth.

On the other hand, many of our daily uses of water are non-essential. We use water to wash our cars or driveways, because they look better when they are clean. We sprinkle our flower gardens and lawns with water, even though we don't use those plants for food. In addition, we often use too much water to accomplish essential tasks. Examples include leaving the water running while brushing teeth, taking long showers or filling the bathtub to the brim before bathing.

This activity will help students become aware of the ways in which they use water each day. Each student will keep a personal "Water Use Journal" for 24 hours. If desired, this journal activity can be expanded so that students keep journals over the course of the entire unit, saving all of their worksheets and observations, writings, drawings, magazine clippings, etc., related to water and human health. Such a journal is useful for review and reinforcement—and it also can provide a vehicle for assessment at the end of the unit.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, pages 14–17
Science Box, page 7

Explorations:
Cover Activity
Not Such a New Issue, page 5

Set-up

This activity will take place over at least two class periods. On Day 1, students will take their journal sheets home with them to record their uses of water. Classroom activities on Day 2 may be conducted with the whole class or with the students in smaller groups.

Procedure

Day 1: Getting started

1. Open a short discussion by asking students to share ways in which people use water every day. Some of the uses that might be mentioned include: washing, drinking, cooking, watering plants, etc.

CONCEPTS

We use water in many ways each day.
Many of the ways in which we use water are not essential for life.

OVERVIEW

Students will keep a personal water-use journal for a day to become aware of the ways in which they use water.

SCIENCE, HEALTH + MATH SKILLS

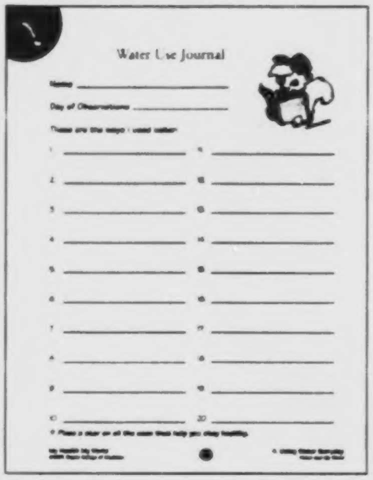
Making and recording observations
Collecting data
Drawing conclusions

TIME

Preparation: 10 minutes
Class: two 30 minute sessions on successive days

MATERIALS

- copy of "Water Use Journal" (1 per student), page 17


Water Use Journal

2. Pass out a "Water Use Journal" sheet to each student. Explain that they will be recording how they use water for the next 24 hours. Stress that each student should record only his or her own uses of water.
3. Let the students take their sheets home with them. Specify the period of time during which they should record their water uses (for example, from the moment they leave the classroom until the moment they return, from the time they arrive home until the time they leave home in the morning, etc.).

Day 2: Talking about the observations

1. With older students, divide the class into groups of 3–4 students. Ask the members of each group to share with one another the uses of water that they reported in their journals. Have them compile a list of all the different water uses that were recorded. With younger students, conduct this session with the entire class. Ask each student to contribute one of the uses of water that he or she recorded. List the uses on the board.
2. Ask, *How many of the uses of water in your list* (or in the list on the board) *help you stay healthy?* Have the students in each group divide the water uses in their list into two categories: "Uses Important for Health," and "Other Uses." Create the same categories and list them on the board with younger students.
3. Have each group share their lists of uses with the rest of the class. Encourage discussion of the students' ideas. Now, present each group with a new challenge. Ask, *In how many of these uses could you save water without affecting your health?* Have each group revisit the uses they have listed and create a new list of "Ideas for Saving Water." Let each group share their ideas.
4. Display the "Ideas for Saving Water" in a central place in the classroom. If desired, have each group create a colorful poster illustrating one of their ideas.

Water Use Facts

Each person needs 8–10 glasses (2.5 quarts) of water each day for health.

Americans each use about 183 gallons of water each day for cooking, washing, flushing and watering.

- Most home water use is in the bathroom.
- 4,000 gallons of water are needed to produce one bushel of corn.
- It takes 1,400 gallons of water to produce a meal of a hamburger, French fries and a soft drink.
- It takes 39,000 gallons of water to produce an automobile.

Source: Environmental Protection Agency, Office of Water, 1996

Typical Amounts of Water Used in the American Home

Amount	Activity
2 gallons	brush teeth
2 gallons	run faucet until water is cold
2–7 gallons	flush toilet
12–20 gallons	run dishwasher
50 gallons	run clothes washer
25–50 gallons	take a 10 minute shower
25–50 gallons	fill bathtub
50 gallons	run garden hose for 5 minutes

Source: Environmental Protection Agency, Office of Water, 1996
http://www.epa.gov/

Water Use Journal

Name ______________________________

Day of Observations ______________________

These are the ways I used water:

1. ________________________
2. ________________________
3. ________________________
4. ________________________
5. ________________________
6. ________________________
7. ________________________
8. ________________________
9. ________________________
10. ________________________
11. ________________________
12. ________________________
13. ________________________
14. ________________________
15. ________________________
16. ________________________
17. ________________________
18. ________________________
19. ________________________
20. ________________________

★ Place a star on all the uses that help you stay healthy.

Diario de Uso de Agua

Nombre ______________________________

Fecha de las Observaciones ______________

Usé el agua para:

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________
11. ______________________
12. ______________________
13. ______________________
14. ______________________
15. ______________________
16. ______________________
17. ______________________
18. ______________________
19. ______________________
20. ______________________

★ Pon una estrella junto a los usos que ayudan a mantenerte con buen sálud.

5. All Dried Up

Background

The cells and tissues that make up living organisms are mostly comprised of water. Each tiny cell is about 70% water. The amount of water in the body of an organism varies by species. For example, water makes up about 90% of the weight of a tomato, 80% of the weight of an earthworm, 70% of the weight of a tree and about 67% of the weight of a human body.

This activity allows students to investigate the amounts of water found in two different fruits, and to use measures of weight and volume. It also introduces them to the concept of drying (or removing water) as a means of preserving foods. This process can be traced back to early uses in Arabia and Egypt around 15,000 BC. Drying also was an important method of food preservation used by the American Indians and the early settlers in North America. When foods are dried, most of the moisture is removed. This process makes many grains, meats and vegetables much less suitable environments for the growth and reproduction of molds, bacteria and insects.

Dehydration also makes foods lighter, and easier to store and transport. Other methods for preserving food that involve dehydration include smoking, which is faster and more effective in preserving foods because the absorbed smoke is toxic to many microorganisms—and salting, which draws moisture out of the food items.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, pages 18–22
Explorations:
Water in Your Body, back page

Set-up

You will need to have a juicer for each group of students. Use commercial plastic ones or make your own by combining the top and bottom pieces of a 2-liter soda bottle (see margin). Each group of students also will need a 1-liter-sized beaker or another soda bottle with the top part removed.

This activity will take at least two class periods, and may be extended to three sessions. The activity should be conducted with groups of 2–4 students.

Procedure

First session: *How much liquid does an orange have?*

1. While holding a bag of oranges in front of the students, ask them how much water might be in the bag. Lead the students into a discussion about the amount of water contained inside an orange.

CONCEPTS

Water is a major component of most foods.

OVERVIEW

Students will investigate the amount of water contained in an orange and an apple.

SCIENCE, HEALTH + MATH SKILLS

Making and recording observations
Weighing
Measuring volume
Estimating
Predicting

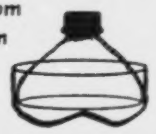
TIME

Preparation: 10 minutes
Class: two 30 minute sessions

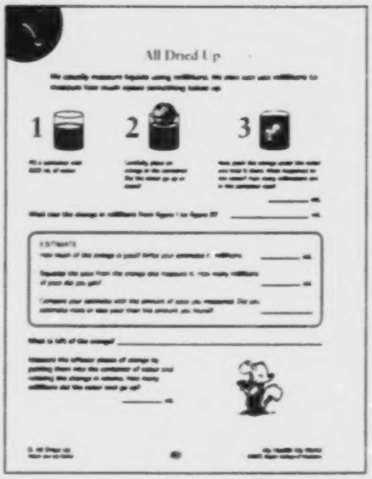
MATERIALS

Each group will need:
- balance (may be shared among groups)
- 2-liter plastic soda bottle with top removed or large beaker
- beaker or clear plastic cup calibrated in milliliters
- hand magnifiers
- juicer (see Set-up for instructions on making your own)
- orange
- apple
- plastic serrated knife
- drinking straw or 2 sheets of paper toweling
- copy of "All Dried Up" sheet, page 22
- water

Juicer made from top and bottom parts of a 2-liter plastic soda bottle.



With the aid of several containers, which are calibrated in milliliters, ask the students to predict the amount of juice contained in a single orange. Make sure that they equate orange juice with water.

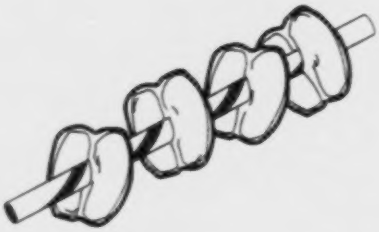


2. Show the students how to measure the volume of an orange by observing and measuring "how much space it takes up." Fill a prepared 2-liter bottle with 800 mL of water. Record the number of mL in the bottle on the board. Then place the orange into the water. It will need to be held down gently, so that the whole orange is submerged. Ask the questions, *Did the water level go up or down? How much? Why?* To help students understand concepts of displacement and volume, talk about what happens to the water when someone gets in a bathtub.
3. On the board, subtract the original volume of the container from the volume in the container with the submerged orange, and record the difference. What does the difference represent? (A standard juice orange will displace about 140–150 mL and will yield 40–50 mL of squeezed juice.)
4. Have each group measure the volume of an orange. Ask the students to suggest ways in which they could measure the amount of juice inside their oranges.
5. Show the students how to squeeze the juice out of an orange. Have them cut the oranges in half using serrated plastic knives. Use the top portions of soda bottles as "juicers," use purchased plastic juicers, or let the students devise their own ways to squeeze out the juice. Have each group squeeze the juice out of one orange. Make sure that the students save the remainders of their oranges.
6. Have the students in each group measure the amount of juice that they obtained. Ask, *How can the remaining material be measured?* If students suggest weighing, have them consider the conversions that might be necessary to equate the information with the earlier measurement in mL. Have students place the remaining orange pieces without juice into the prepared 2-liter container and read the new volume. *Has the amount of water displaced changed? Why? What was the volume of the entire orange? What is the volume of the remaining "stuff"? What part of the orange was water?* Have them record the values that they have obtained on the "All Dried Up" observations sheet.

The ancient Greek scientist, Archimedes, was the first to note that a submerged object displaces an amount of water equal to its own volume.

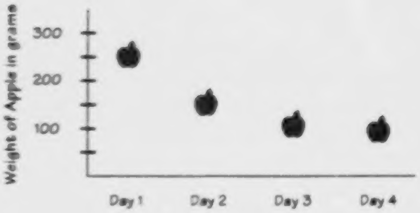
Second session: ***How much liquid does an apple have?***

1. Ask the class, *Do you think other foods contain water? How about an apple?* Encourage the students to predict whether apples and other fruits and vegetables contain water. *How could we find out?*
2. Give each group of students an apple and a plastic serrated knife. Direct the students to weigh the apples, record the values and cut the apple into slices (about ½ cm in thickness). Have them set the slices between 2 sheets of paper toweling, or skewer the slices along a straw. Let the apples sit in a warm place for [illegible]–5 days. (The amount of time will vary depending on the temperature.)



Students can skewer apple slices on a plastic drinking straw.

3. Have the students weigh the slices together every day and record the weights. When the slices do not show an appreciable change in weight from one day to the next, they have dried as much as will be possible. Have older students make a graph of the daily weights of the apple slices.
4. Have students in each group subtract the final weight of the slices from the starting weight of the apple. This will give the weight of the water that originally was present in the apple.



Change in Apple Weight over Time

Variations

- Students also may want to compare weight differences between raisins and grapes, dehydrated potato slices (packaged potato casserole mixes) and fresh potato slices, banana chips and fresh slices of banana, beef jerky and strips of raw beef, or dried peas and fresh peas.

- Approximately 60% or 6/10 of the human body consists of water. Let students calculate approximately how much of their own weight is water using the following formula:

Step 1. Your weight × 6 =

Step 2. Value from Step 1 ÷ 10 = amount of water in body.

OR

Step 1. Count out the number of snap-together math cubes equal to your weight, i.e., 45 lb = 45 cubes.

Step 2. Separate into 10 equal groups.

Step 3. Place six of the groups in one set and four in the other set.

Step 4. The largest set equals the part of your body that is water.

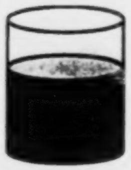
Questions for Students to Think About

- In this activity, water is measured in two different ways—by volume and by weight. *Which of these two measures is used most commonly for liquids? Why do you think so? Can you find a way to convert a measure of volume to a measure of weight or vice versa?*

All Dried Up

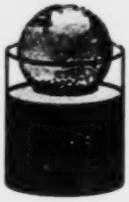
We usually measure liquids using milliliters. We also can use milliliters to measure how much space something takes up.

1



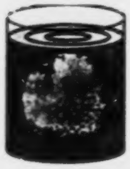
Fill a container with 800 mL of water.

2



Carefully, place an orange in the container. Did the water go up or down?

3



Now, push the orange under the water and hold it there. What happened to the water? How many millimeters are in the container now?

_______________ mL

What was the change in milliliters from figure 1 to figure 3? _______________ mL

ESTIMATE

How much of the orange is juice? Write your estimate in milliliters. _______________ mL

Squeeze the juice from the orange and measure it. How many milliliters of juice did you get? _______________ mL

Compare your estimate with the amount of juice you measured. Did you estimate more or less juice than the amount you found? _______________

What is left of the orange? _______________

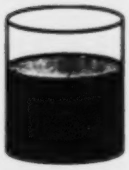
Measure the leftover pieces of orange by putting them into the container of water and noticing the change in volume. How many milliliters did the water level go up?

_______________ mL

Completamente Seco

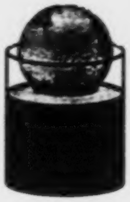
Generalmente medimos los líquidos en mililitros. También podemos usar mililitros para medir el espacio ocupado por un objeto.

1



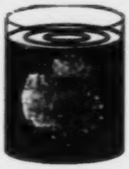
Llena un envase con 800 mL de agua.

2



Con mucho cuidado, mete una naranja en el envase. ¿Subío o bajó el nivel del agua?

3



Ahora, empuja la naranja hacia abajo del agua y detenla allí. ¿Quele pasó al nivel del agua? ¿Cuantos mililitros hay en el envase?

____________ mL

¿Cuantos mililitros cambió el nivel del agua de figura 1 a figura 3? ____________________ mL

ESTIMAR

¿Qué tanto de la naranja es jugo? Escribe tu estimación en mililitros. ____________ mL

Exprime todo el jugo que puedas de la naranja. ¿Cuantos mililitros de jugo obtuviste? ____________ mL

Compara tu estimación con la cantidad de jugo que obtuviste. ¿Hubo más o menos jugo de lo que estimaste? ________________

¿Qué quedó de la naranja? ____

Ahora, puedes medir el volumen de los pedazos restantes de la naranja. Sumérjelos todos en un envase con agua y observa el cambio en el nivel del agua. ¿Cuantos mililitros subió el nivel del agua?

____________ mL

6. Water Any Body?

Water is a unique substance upon which all life depends. It is essential both inside cells, where it provides the medium in which all chemical reactions take place—and outside cells, where it is necessary for the transport of nutrients and other materials and for the removal of wastes.

On land, plants and animals must find ways to conserve water within their bodies. In animals, water is lost through evaporation from lung surfaces and from the general body surface, elimination in feces and excretion in urine. The water that is lost must be replaced.

The bodies of most land animals are adapted to minimize the amounts of water that are lost through excretion and elimination. The kidneys, for example, are extremely efficient in using water. Even though approximately 170 liters of water are cycled through the kidneys of a human being each day, almost all of this water is reabsorbed. Water that is used during the digestion of food also is reabsorbed by the body. This process occurs in the large intestine.

The threat of water loss from the body is especially significant for animals living in dry environments. Most of these animals have evolved special strategies to conserve water. Kangaroo rats living in deserts, for example, hardly ever drink water. They obtain almost all of the water they need from the chemical breakdown of the grains that they eat. To reduce water loss from their bodies, the rats are not active during the hottest parts of the day, they produce very dry feces, and they release extremely concentrated urine.

An average human doing light work in a temperate climate loses nearly 5 pints (3 liters) of water daily. This water must be replaced to keep the body functioning optimally.

Healthy human beings show the effects of water deprivation (dehydration) after about three days. Death is likely when water loss reaches about 20% of the total volume of water in the body. This amount is approximately 2.75 gallons (22 pints or 12 liters) in a medium-sized adult. On the other hand, as long as water is available, it is possible to lose over half of the body's weight and to survive for up to two months without food.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, pages 23–25
Revisit Science Boxes, pages 3 and 14

Explorations:
Intestine puzzle and *Try This*, page 4

CONCEPTS

Water is essential for survival.
Our bodies take in and release balanced amounts of water each day under normal conditions.

Overview

Students will learn about the amounts of water lost through different normal, daily activities.

Science, Health Math Skills

Making and recording observations
Calculating values based on observations
Measuring

Time

Preparation: 20 minutes
Class: 45 minutes

Materials

water
beakers or clear plastic cups calibrated in milliliters (1 per group)
containers or tubs with a minimum capacity of 3 liters (2 per group)

People who are exercising more vigorously can lose much more water than people who are not. For example, someone doing hard work in the sun can lose as much as 20 pints. The greatest daily loss ever recorded was 50 pints in a single day!

Set-up

Use beakers or graduated cylinders for this activity, or make your own (or have students make their own) by calibrating clear plastic cups ahead of time. Conduct this activity with groups of 2–4 students. Materials Managers should pick up supplies for each group of four.

Procedure

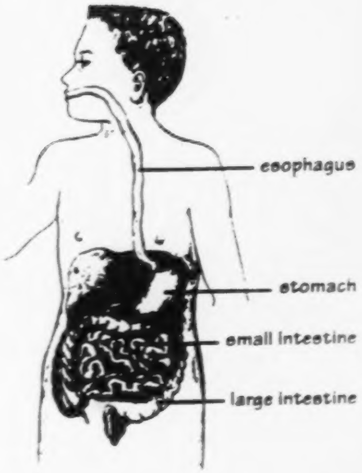
1. Have the students in each group measure 3,000 mL (3 liters) of water into one of the large tubs or containers. This is the amount (volume) of water that enters the body in food and liquids during a typical day.
2. Have students take turns measuring out the following quantities of water from the first container and emptying them into the second container.
    - 150 mL - water eliminated by the intestines
    - 600 mL - water lost as vapor during breathing
    - 1,500 mL - water eliminated as urine
    - 750 mL - water lost as perspiration
3. Ask the students to record the amount of water left in the first container. (It all will be gone!) Ask, *What would happen if no water entered the body?*
4. Have the students think of different ways water could be returned to the body. In their groups, let them create plans or strategies to replace the 3,000 mL of water needed by the body each day to survive. Note that about half of the water we need can come from food, and that about 300 mL of water per day is produced inside the body as energy is released from food. Have students share their ideas with the rest of the class.

Variations

- Have students explore the volume of water filtered by the kidneys, by figuring out how many 2-liter soda bottles of water would be processed each day. (The kidneys process approximately 170 liters of water each day.)

Questions for Students to Think About

- Desert organisms have had to adopt special strategies to save water. Investigate some of the unique characteristics of desert dwellers by using resources in the library or available on computer.
- Aquatic organisms (plants and animals that live in water) have another problem—too much water. See what you can find out about the strategies used by aquatic organisms to survive while submerged.



Loss

150 mL lost by elimination from digestive system (feces)
1,500 mL lost in urine
600 mL lost by evaporation during breathing
750 mL lost as sweat

Replacement

1,500 mL replaced from liquid water
1,200 mL replaced from food
300 mL replaced from the release of water molecules during the chemical breakdown of food (respiration)

Environmental Health Basics

Water Pollution and Health

All the water on Earth ultimately forms part of a single, immense system. Oceans, wetlands, streams, lakes and underground water supplies are all linked through drainage patterns in watersheds and through the endless cycling of water on our planet. Because water sources are connected, pollutants travel from one part of the system to another and, eventually, can affect very distant ecosystems and populations (human and wildlife).

Water pollutants can be divided into several major categories, all of which impact human health and well-being.

- **Nutrients.** These can come from chemical sources (fertilizers or detergents) or can be organic in origin (sewage or manure). Nutrients usually are carried into water sources by rainwater. They cause excessive growth of water plants and algae, which can clog navigable waterways and use up oxygen (needed by other organisms such as fish) when they decompose. These changes cause the decline of important lakes and wetlands, and can affect drinking water quality as well. In groundwater, fertilizers can make water from wells unsafe to drink.
- **Soil and sand from plowed fields, construction sites, logging sites, urban lands and areas being strip-mined.** These sediments make lakes, wetlands and streams more shallow, affecting the use of waterways for transportation and decreasing the quality of habitats for wildlife. Washed-off soil also can be a source of excess nutrients.
- **Disease-causing organisms.** Bacteria, viruses and single-celled parasites can enter water supplies from inadequately treated sewage, storm water drainage, septic systems, livestock pens, and boats that dump human wastes. These organisms cause diseases such as dysentery and typhoid, as well as skin and respiratory illnesses.
- **Metals** (such as mercury and lead) **and toxic chemicals** (such as those found in pesticides, herbicides, cleaning solvents, plastics and petroleum derivatives). These substances can threaten human health as well as that of wildlife. Metals and many manufactured chemicals persist in the environment. They accumulate in the tissues of fish and other animals, and can find their way into groundwater making it unsafe to drink.
- **Heat.** Warm water discharged from power plants (where water is used for cooling) can drastically alter aquatic ecosystems. Changes in water temperature can affect the quantity of oxygen in the water and can make some organisms more susceptible to disease, parasites and toxic chemicals.

Most sources of water pollution are spread over large areas. Water from rain and irrigation collects pollutants as it washes over the land or sinks into the soil. This type of pollution, which is not attributable to a single location, generally is referred to as non-point source pollution. It is much more difficult to monitor and to control than point source pollution—which is pollution that is discharged at a single place (such as from a factory, a single waste treatment plant or an oil spill).

The Safe Drinking Water Act of 1974 required the Environmental Protection Agency (EPA) to establish national standards for drinking water quality. The EPA sets maximum allowable concentration levels for pollutants that can harm human health. However, only municipal drinking water sources are tested by law. Privately owned wells are not required to meet federal drinking water standards.

7. Pollution Dilution

Background

Water can look clean and clear, and still contain many different types of chemical and biological materials. Most of these are harmless—especially in tiny quantities. In fact, even water that comes from crystal clear wilderness sources, or water that is sold in stores as "natural" spring water, contains dissolved minerals and other substances.

On the other hand, some types of water contaminants are harmful to human health even in very small amounts. The concentration of many of these substances usually is measured in parts per million or even in parts per billion. The Environmental Protection Agency monitors the presence of tiny amounts of potentially harmful chemicals in drinking water sources.

The following exercise lets students create a solution that contains a concentration of one part per million of commercial food coloring.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, pages 26–31
Explorations:
Let's Talk About Water and Health, pages 2–3
Riff and Rosie Talk to Ms. Linda Holman, page 7

Set-up

Use commercially available chemistry trays OR cut the bottoms of plastic egg cartons in half to create chemistry trays with 6 wells for this activity OR give each group of students 6 small disposable cups. Number the wells (or cups), 1 through 6, with a permanent marker.

Students should carry out this activity in groups of 2–4. Set up a station in a central area with several dropper containers of food coloring and the other materials that each group will need.

Procedure

1. Make sure that each group has a chemistry tray (or 6 cups), a small beaker or glass of tap water, 2 empty beakers or glasses, and 2 eyedroppers. Have a student from each group place 10 drops of food coloring into one of the empty beakers.
2. Following the instructions on the "Drop by Drop" student sheet, each group should place one drop of food coloring from the beaker into Well 1. Using the second eyedropper, they then should add nine drops of water to the well. Ask, *How many colored drops did you add to the well? How many drops are in the well all together?*
3. Let the students rinse the first eyedropper with tap water (squirting the excess into the second beaker) and then instruct

CONCEPTS

Substances dissolved in water can be present in very tiny amounts that are not visible to the eye.

OVERVIEW

Students will make a solution of food coloring with a concentration of one part per million.

SCIENCE, HEALTH, + MATH SKILLS

Using eyedroppers as a measuring tool
Observing
Reaching conclusions

TIME

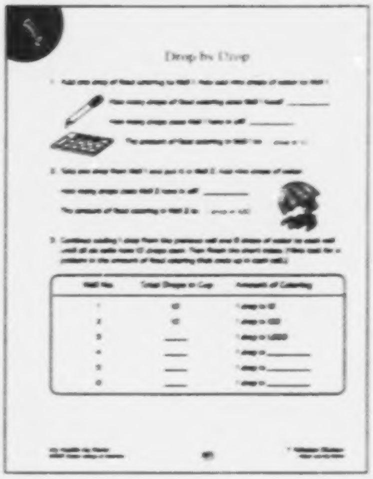
Preparation: 10 minutes
Class: 30 minutes

MATERIALS

Each group will need:
- copy of "Drop by Drop" sheet, page 29
- dropper container of blue or red food coloring
- chemistry tray or 1/2 plastic egg carton or 6 small cups
- 2 eyedroppers
- 2 beakers or clear plastic cups
- water

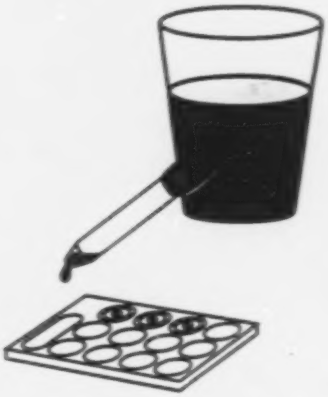
them to collect one drop of the mixture from Well 1 and place it in Well 2. Next, have them add nine drops of water to the well. Each group should repeat the procedure, using one drop from the previous well until all six wells are filled.

4. When students have completed making their solutions, have them observe the colors of the solutions in the different wells. Ask, *What happened to the color of the water in the different samples? In which sample does the color seem to disappear? Does this mean that there isn't any food coloring at all in the water?*
5. Look at the fractions represented on the "Drop by Drop" sheet. Make sure that the students notice that the concentration in Well 6 is one part in one million. Each of the wells has a solution that is 10 times more diluted than the solution in the preceding well. Ask, *Is there another way that we could make a mixture that has one part in 1 million?* (One way is to add 1 drop of food coloring to 999,999 drops of water! Another would be to add one drop of food coloring to a full bathtub of water—this would be an approximation.)
6. Hold up a glass of tap water. Ask, *What about this water? Could it also have tiny amounts of other things in it? What might those tiny things be?* Possible answers could include minerals, microorganisms (germs), or chemicals. *Are all of these things necessarily harmful?* Help students understand that almost no water, except in a laboratory, is completely pure. On the other hand, point out that some pollutants can be harmful to human beings in very tiny amounts, often measurable only in parts per million or parts per billion (for example, heavy metals like lead and mercury, pesticides and some industrial chemicals). Mention that certain city, county, state and federal agencies test drinking water for potentially harmful chemicals. *Why might this be important?*



Variations

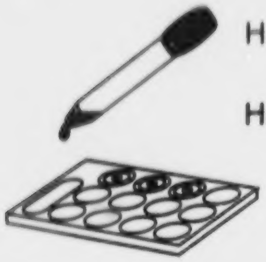
- Refer students to the "Riff and Rosie Talk to . . ." section on page 7 of the *Explorations* mini-magazine, *Water and My World.* It features a microbiologist who tests water for levels of disease-causing organisms.
- The Safe Water Drinking Act of 1974 requires that the Environmental Protection Agency (EPA) set and enforce standards of safety for drinking water in the United States. Have older students check resources in the library or on the World Wide Web to find out which substances currently are considered hazardous by the EPA.
- Water treatment plants typically pass water through a complex filtering process to remove suspended particles, and add chlorine to kill disease-causing organisms. Sometimes water also is sprayed into the air to help evaporate some kinds of chemicals and to improve its taste and smell. See if you can organize a visit to your municipal water treatment plant or have a representative from the local water or health department visit your classroom.



Students will create a series of dilutions by successively adding one drop of solution to nine drops of water.

Drop by Drop

1. Add one drop of food coloring to Well 1. Now add nine drops of water to Well 1.



How many drops of food coloring does Well 1 have? ______

How many drops does Well 1 have in all? ______

The amount of food coloring in Well 1 is: 1 drop in 10.

2. Take one drop from Well 1 and put it in Well 2. Add nine drops of water.

How many drops does Well 2 have in all? ______

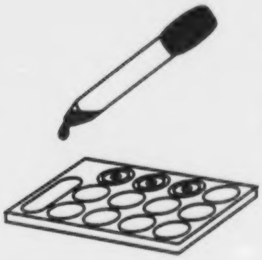
The amount of food coloring in Well 2 is: 1 drop in 100.

3. Continue adding 1 drop from the previous well and 9 drops of water to each well until all six wells have 10 drops each. Then finish the chart below. (Hint: look for a pattern in the amount of food coloring that ends up in each well.)

Well No.	Total Drops in Cup	Amount of Coloring
1	10	1 drop in 10
2	10	1 drop in 100
3	______	1 drop in 1,000
4	______	1 drop in ______
5	______	1 drop in ______
6	______	1 drop in ______

Gota a Gota

1. Añade una gota de colorante para alimentos a la Taza 1. Ahora, añade nueve gotas de agua a la Taza 1.



¿Cuantas gotas de colorante tiene la Taza 1? ____________

¿Cuantas gotas tiene la Taza 1 en total? ____________

La cantidad de colorante en la Taza 1 es: 1 gota en 10.

2. Toma una gota de la Taza 1 y ponla en la Taza 2. Añade nueve gotas de agua.

¿Cuantas gotas tiene la Taza 2 en total? ____________

La cantidad de colorante en la Taza 2 es: 1 gota en 100.

3. Continua añadiendo 1 gota de la taza anterior y 9 gotas de agua a cada taza hasta que las seis tazas tengan 10 gotas cada una. Ahora, completa la tabla abajo. (Una sugerencia: fíjate si hay un patrón en las cantidades de colorante que están en las tazas.)

Taza Número	Total de Gotas en la Taza	Cantidad de Colorante
1	10	1 gota en 10
2	10	1 gota en 100
3	____	1 gota en 1,000
4	____	1 gota en ____________
5	____	1 gota en ____________
6	____	1 gota en ____________

41

8. Separating Solutions

Background

Small amounts of many different substances can be dissolved in water at the same time. Many of these are not visible or distinguishable when they are mixed together in water. This activity lets students detect the presence of several different food dyes in water by using a simple separation technique.

The technique, called chromatography, takes advantage of the "sticky" qualities of water, which help it travel up through a piece of filter paper. When this happens, the water molecules are attracted to charged regions on the cellulose molecules that make up the paper. As water moves up, it also carries other molecules with it (such as the food coloring used here). Different molecules will move up the paper at different rates based on their sizes and by how much they are attracted to the molecules of water. As a result, the different substances (food coloring dyes in this case) will form separate bands or spots on the filter paper.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, revisit Science Boxes on pages 17 and 24
Explorations:
Riff and Rosie Talk to Ms. Linda Holman, page 7

Set-up

Before beginning the activity, prepare a "mystery liquid" by adding 10–15 drops each of red, blue and green food coloring to about one cup of water.

Have students conduct this activity in groups of 2–4. Set the materials out in a central area for the Materials Managers to pick up.

Procedure

1. Show the mystery liquid to the students. Ask, *Can you tell what's in this liquid?* Explain that each student is going to be a detective and investigate the mystery liquid.
2. Students will need to prepare a test strip of filter paper. Give each group 1–2 basket-type coffee filters. Have the students smooth the filters so that they lie as a flat circle. Each student should cut a strip of filter paper 2 cm wide by 15 cm long.
3. Give each group an 8-oz clear plastic cup or a 250-mL beaker with about 1 cm of the mystery liquid in the bottom. Tell the students that they will be putting the tips of their strips into the mystery liquid. Ask for predictions about what might happen.

Concepts

Many different substances can be dissolved in water at the same time.

Overview

Students will use simple paper chromatography to investigate a "mystery liquid."

Science, Health + Math Skills

Measuring
Predicting
Making observations
Reaching conclusions

Time

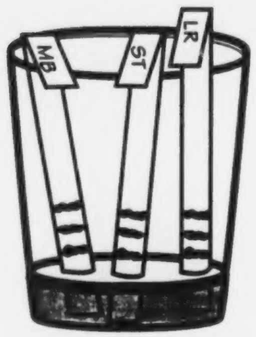
Preparation: 10 minutes
Class: 30 minutes

Materials

round basket-type coffee filters (1–2 per group)
red, blue and green food coloring
8-oz clear plastic glass or 250-mL beaker per group
scissors (1–4 per group)
rulers (1–4 per group)
water

The word "chromatography," comes from the Greek words *chroma* (color) and *graphein* (to write).

4. Have each student write his or her initials in pencil or permanent ink at the top of his or her filter paper strip. Then have them place the tips of the strips in the liquid and fold the strip over the side of the glass or beaker so that the strip stays upright. (The activity will work better if the strips are not pressed against the sides of the glasses or beakers.)
5. Have the students observe their strips for 5–10 minutes. As the color begins to rise up the strips, ask, *What is happening to the mystery liquid?*
6. Once the liquid in the strips has risen to about 2 cm from the top of the cup, have the students carefully remove their strips and lay them on a piece of paper toweling to dry. Ask them to observe the colors. *How many colors are on your strips? What colors are they?* Let each student report which colors appeared on his or her strip. (Usually three bands will form—blue at the top, followed by yellow or green, followed by red at the base.) *What does this tell us about the mystery liquid? How many things were mixed together to make the liquid?*
7. The strips may be preserved in a notebook or displayed in class after they are dry. Encourage students to extend their results to other situations. *Since several different things were mixed together in the mystery liquid, do you think that other types of liquids can be mixtures of different substances?*



Students will observe the bands of color that appear on the filter paper strips.

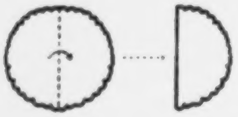
Variations

- After conducting the activity with filter paper strips, let students fold and cut snowflakes out of coffee filters. Set the folded snowflakes in the cups, with the tips in the mystery liquid to color the snowflakes in rainbow patterns.

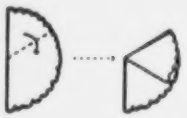
Folding Paper Snowflakes

To create a six-sided snowflake:

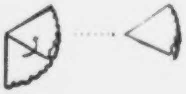
1. Fold a flattened coffee filter in half.



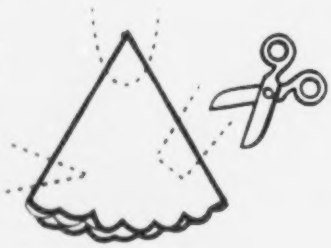
2. Fold approximately one-third of the folded filter toward the center.



3. Fold the remaining third toward the center to create a triangular shape.



4. Cut a pointed tip and other designs on the folded triangle, being sure to leave some folded edges intact on each side.



5. Open your snowflake.

9. Make a Muddled Marsh

Background

In general, two types of sources contribute to water pollution in the United States. Point sources introduce pollutants into waterways at single places. Factories, sewage treatment plants, abandoned mines and oil tankers are examples of point sources of water pollution. While this type of pollution is not always significant in terms of volume, it is, however, the major point of entry for toxic chemicals into water supplies. In most cases, point sources of pollution easily can be identified and monitored by government agencies.

Non-point sources of pollution include large areas of land that drain into underground and surface water sources. With non-point source pollution, pollutants are collected by water as it travels over land and through layers of soil. Major contributors to non-point source pollution include agricultural activities (which can add chemical fertilizers, pesticides, manure and soil to water), logging and other activities that leave the soil surface bare (allowing soil to be washed into waterways), urban and suburban areas (where lawn chemicals, household chemicals, motor oil and gasoline can be washed into water supplies), and septic systems (which can contaminate underground water supplies with disease-causing bacteria). Unlike point sources of pollution, non-point sources are much more difficult to monitor and control because they can be spread over many square miles.

In the story, *Mystery of the Muddled Marsh*, which accompanies this unit, runoff from a new park development introduces soil and fertilizers into a marsh and stream ecosystem. The soil and fertilizers lead to murky water and excessive growth of plants, green algae and some microorganisms in the marsh, threatening the marsh animals and their habitat. Riff and Rosie (characters in the story) are able to connect development of the park to changes that they have observed in the marsh.

In this activity, students will have an opportunity to view the changes that occurred in the marsh on a small scale by introducing fertilizers to solutions of pond water or hay infusions and observing changes in the water over time.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, revisit Science Boxes on pages 10 and 21
Explorations:
We Can Make a Difference!, page 6

Concepts

- Many different kinds of organisms live in water.
- Excess nutrients will cause over-abundant growth of many organisms living in water.
- Non-point source pollution is a major threat to water supplies in the United States.

Overview

Students will create pond water communities and investigate the effects of adding fertilizers or natural nutrients.

Science, Health + Math Skills

- Measuring
- Predicting
- Observing
- Reaching conclusions

Time

Preparation: 30 minutes
Class: 3 sessions of 30 minutes

Materials

- hay infusion kit or water from a pond, ditch or stream (about 1 liter of pond water per group)
- large plastic soda bottles (3 per group)
- funnels (1 per group)
- small container fish food
- small container water-soluble plant food
- dried grass or hay if preparing hay infusion
- tap water without chlorine for hay infusion
- copies of Muddled Marsh Observations sheet (1 per student per group), page 36

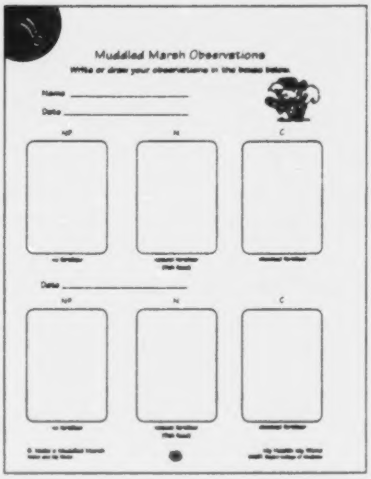
Set-up

You will need pond water to carry out this activity. You may use water that you or your students have collected from a pond, ditch or stream, or you may prepare your own using a hay infusion kit. If you are collecting your own pond water, try to find water that has bits of green algae floating in it. If you will be using a commercial hay infusion kit, set up a culture about a week before beginning the activity.

When using a hay infusion kit, you also will need water without chlorine. Collect rainwater, let tap water rest for 24 hours uncovered in a bucket, or use dechlorination tablets available from pet stores to treat tap water.

Each group of students will need to bring three clear 2-liter-sized plastic soda bottles from home. Cut the tops off the bottles to make cylindrical containers.

Have students conduct this activity in groups of 2–4. Set the materials out in a central area for the Materials Managers to pick up.



Muddled Marsh Observations

Name

Date

NF N C

Date

NF N C

Procedure

Session 1: Set up pond water cultures

1. Begin by asking students if they remember what happened to Mr. Slaptail's marsh. Allow time for everyone to share their ideas. Then, tell the students that they will be able to see some of the tiny plants and animals that lived in the Muddled Marsh and also observe what happens when too much fertilizer is added to a water ecosystem.
2. Have the members of each group label their three bottles: "NF" (no fertilizer, or control); "N" (natural fertilizer); and "C" (chemical fertilizer). In bilingual classrooms, label the containers "SF" (sin fertilizante), "N" (fertilizante natural) and "Q" (fertilizante químiro).
3. Show the students the pond water that you have collected or the hay infusion that you prepared previously. If possible, put a few drops of the water under a microscope for students to observe. Explain that they will be growing similar living things in their bottles. Have the students add about 250–500 mL of the pond (or prepared) water to each of their bottles (along with some hay or grass, if using hay infusions).
4. Set the soda bottles in a bright window or under fluorescent lights in a growth chamber for 1–2 days. (In conditions with low light, hay infusions will tend to develop mold and/or foul smelling bacteria within 2–3 days.) If the pond water already has plenty of green algae and other growth, proceed directly to the next step without resting the cultures.

If possible, let students observe some of the minute organisms present in the pond water.

Session 2: Beginning the experiments

1. Have the students in each group observe their three [illegible]les. Ask, *Do you notice any differences among the bottles? Why [illegible]hy not?*

2. Explain to the students that they will be looking at what happens when too much fertilizer is added to aquatic ecosystems. Most students will be familiar with the word "fertilizer" from the story, *Mystery of the Muddled Marsh*. Make sure that they understand that fertilizer has good applications and that it can be very important for food production.
3. Show the chemical fertilizer and the fish food to the class. Help the students understand that both substances will add nutrients to the water in the bottles.
4. Instruct the students to add three drops of liquid fertilizer to the bottle labeled "C," and a large pinch of fish food to the bottle labeled "N." Have each group make predictions about what they think will happen in each bottle over the course of the next week. The bottles should be kept in a bright window or under fluorescent lights in a plant growth chamber.

Students will be able to observe the effects of adding nutrients to a water community.

Session 3: Looking at results

1. Have students observe their bottles every day and write or draw their observations on the "Muddled Marsh Observations" sheets.
2. After about a week, have students discuss their results with other members of their group. Have them compare the appearance of the three bottles. *Which bottle has the cloudiest water? Which bottle has the clearest water?* Students also may be able to observe differences in the color and/or amount of organisms in their bottles. Older students may want to compare the amount of organisms in a drop of water from each of the three bottles.
3. Discuss the results with the class. Ask, *What happened when we added more nutrients to the water in the bottle? What do you think will happen if we continue to add more nutrients to the bottles?* Help the students make extensions to other situations by asking, *What do you think we can do to reduce the amount of fertilizer that washes into lakes and streams? What would happen if no one used fertilizers at all? Can you think of ways that let us use the fertilizer we need to grow food and still not pollute our waterways?*

Variations

- Visit a nearby stream, marsh pond, or ditch with standing water and let students collect small samples of water. Have students observe their water samples in class using magnifiers or low-power microscopes (if possible) and compare their observations to the water in the soda bottles.
- Keep one or more cultures of pond water alive in the classroom for longer periods of time by aerating the culture with a simple aquarium pump and plastic tubing inserted into the water.

Muddled Marsh Observations

Write or draw your observations in the boxes below.

Name ______________________________

Date ______________________________

NF	N	C
no fertilizer	natural fertilizer (fish food)	chemical fertilizer

Date ______________________________

NF	N	C
no fertilizer	natural fertilizer (fish food)	chemical fertilizer

Observaciones sobre el Pantano Perturbado

Escribe o dibuja tus observaciones en los cuadros.

Nombre ____________________________

Fecha ____________________________

SF	N	Q
sin fertilizante	fertilizante natural (alimento para peces)	fertilizante qúimico

Fecha ____________________________

SF	N	Q
sin fertilizante	fertilizante natural (alimento para peces)	fertilizante qúimico

10. Water—Got to Have It

Background

Water is essential for all of life on our planet. It must be present in order for plants and animals to survive. People need water every day, not only to keep their bodies healthy and clean, but also to do many other things.

Water is used both at the personal and the community levels—from brushing teeth, to washing dishes, to running automobiles, to growing vegetables, to manufacturing paper and machinery, to drilling for oil, to generating electricity! We even use water for recreation! However, while more and more people inhabit the Earth, using more and more water, the supply of usable fresh water on the planet remains fixed. Consequently, water must be used wisely.

Water constantly is used and reused. In nature, it is circulated through the water cycle. Unfortunately, the same unique properties of water that make it vital for all life also make it susceptible to contamination by human beings from a variety of sources. Nutrients, soils and sediments, chemicals, heavy metals and disease-causing organisms all can be dissolved or mixed with water as a result of human activities. Pollution from these sources can harm human health and cause irreparable damage to valuable ecosystems. The best way to keep water supplies clean is through prevention.

This activity will allow students, individually or collectively, to review the importance of water in their lives and reach some conclusions regarding the importance of clean water to human health.

Links

This activity may be taught along with the following components of the *Water and My World* unit.

Adventures:
Mystery of the Muddled Marsh, revisit Science Boxes on pages 2, 3 and 7
Explorations:
Cover Activity
Tips for Healthy Living, page 3

Set-up

Have students work individually or in groups of four.

Procedure

1. Review the importance of water to health and aspects of water pollution with the class. Have the students suggest different ways in which water is important to health (both positive and negative). List their suggestions on the board or on an overhead projector.
2. Explain to the students that they will be drawing (and to older students—writing about) what they consider the MOST IMPORTANT aspects of water for health. Explain that they may

Concepts

- Water is a special chemical compound with unique properties.
- All life on Earth depends on water.
- Water can be polluted easily from a variety of sources.
- Everyone can help keep our water supplies safe.

Overview

Students will review points covered in this unit and reach conclusions regarding the importance of water to human health.

Science, Health Math Skills

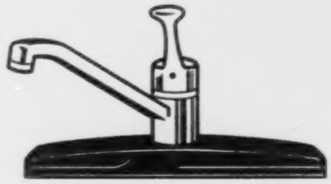
- Problem solving
- Drawing conclusions

Time

Preparation: 10 minutes
Class: 45 minutes

Materials

- drawing paper (1 sheet per student) or large sheet of butcher paper (1 per group)
- crayon, pencils, paints, etc.



consider any of the things that they have learned over the course of the unit and that they may look at both negative and positive impacts of water and water pollution on health.

3. Have students fold a sheet of paper into fourths and draw an important health-related aspect of water in each box. Have older students also write a sentence or paragraph explaining the significance of each drawing. The drawings and paragraphs can be added to their water journals, if students have kept journals for the entire unit.

   OR

   Have the students work in groups. Give each group a large section of butcher paper and let them divide it into four sections. Have each group decide on the uses of water that they will depict as they create their own "water and health mural."

2. Display the drawings or murals around the classroom. Let each student or group share their work with the rest of the class.

Variations

- Let students collect pictures from magazines and newspapers to use in their pictures or murals.
- Challenge students to imagine what the Earth would be like if clean water quickly began to disappear. In small groups, let each person share an idea about one of the consequences of limited supplies of clean fresh water. Using the cooperative group concept, have the recorder in each group write down the ideas. Have the groups share their ideas with the rest of the class.

WOW Publications

My Health My World® Activities
Developed by
Baylor College of Medicine
Houston, Texas
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THE READING LINK

Reading activities to use with

MYSTERY OF THE MUDDLED MARSH

RIFF AND ROSIE

MY HEALTH MY WORLD

WATER AND MY WORLD

The Reading Links have been created as ready-to-use reading and writing activities that are directly related to My Health My World adventure stories. They are not intended to represent a comprehensive reading program. The activities are related to reading objectives common to many curricula and covering a range of grade and ability levels. Teachers may wish to select from these activities those that are most appropriate for their own students.

Prepared by
Baylor College of Medicine
Houston, Texas
2000

Word Meaning/Context Clues

A. Find the word that fits best in each blank space. Fill in the circle by your answer.

1. The water in the creek was so ______________ that Riff could not see the bottom.
   - ○ clear
   - ○ cold
   - ○ polluted
   - ○ sparkling

2. The beaver's ______________, made of sticks and twigs, would not let water go through.
   - ○ dam
   - ○ garden
   - ○ marsh
   - ○ pond

3. The ______________ is causing the plants to grow too much.
   - ○ scum
   - ○ oxygen
   - ○ fertilizer
   - ○ turtle

4. If Mr. Otterbee couldn't catch fish to eat, he would have to become a ______________.
   - ○ vegetarian
   - ○ carpenter
   - ○ reptile
   - ○ dinosaur

B. **Many Meanings.** Sometimes a word can have more than one meaning. Look at the different meanings for **gear** and **spring**. Then pick the meaning of those words that fits best in each sentence. Write its number next to the sentence.

gear
1. part of a machine that controls speed
2. equipment; things to use for a special purpose

_____ Riff threw his camping gear into his backpack.

_____ Mr. Otterbee shifted the tractor into high gear.

spring
1. jump up; leap
2. coiled wire used in chairs and beds
3. season between winter and summer
4. flow of water out of the ground

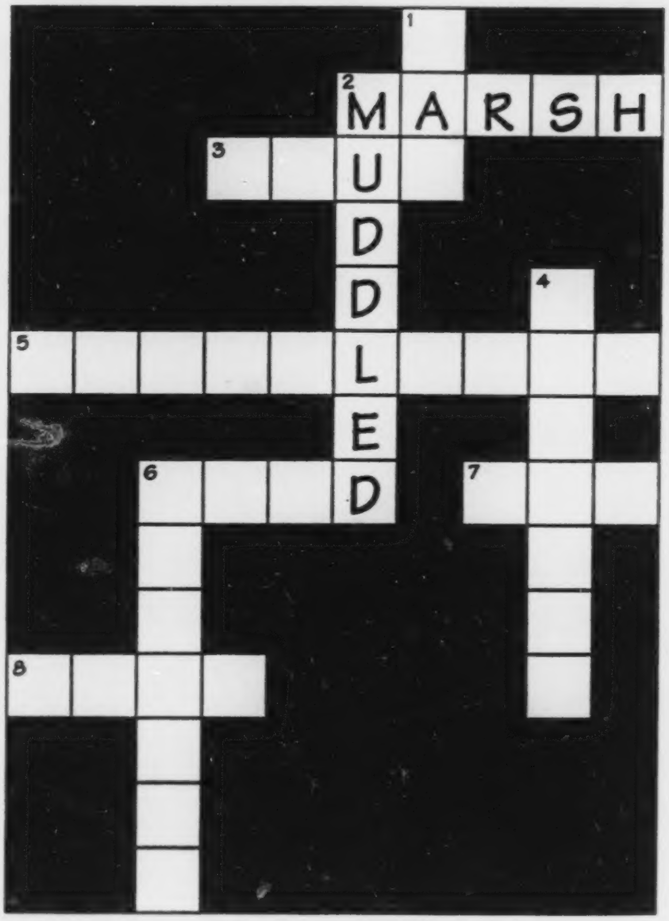
_____ Water bubbled up from the spring.

_____ Watch Rosie spring off the diving board.

_____ A spring was popping out of the sofa.

_____ Tulips bloom in the spring.

C. **A Muddled Marsh Crossword Puzzle.** All of the words in this crossword puzzle are in the story, *Mystery of the Muddled Marsh.*



Across

2. Low, wet land covered by grasses and other small plants
3. A slimy coating on top of water
5. A substance added to soil so that plants will grow better
6. A body of water that is smaller than a lake
7. Not young, but _______
8. To bend one part over another

Down

1. A barrier across a waterway that controls the flow of water
2. Mixed up; messed up
4. Land covered with shallow water most of the time
6. To make dirty or impure

Sequence of Events

A. Read pages 1 and 2 in *Mystery of the Muddled Marsh*. Which one of the three things below happened FIRST? Write 1 next to it. Then write 2 by the event that happened next, and 3 by the one that happened last.

_____ Riff almost knocked Mr. Slaptail into the pond.

_____ Rosie bumped into Mrs. Pondslider.

_____ Rosie bet that her boat would beat Riff's boat across the pond.

B. After you have read the whole story, find which event below happened LAST. Write 4 next to it. Then write the numbers 1, 2 and 3 to show the order in which the other events happened.

_____ Riff, Rosie and Mr. Slaptail discovered the new park, with new grass and plants.

_____ Riff and Rosie met all of the neighbors as they were moving out of the marsh.

_____ All of the neighbors got together to clean up the marsh.

_____ Riff, Rosie and Mr. Slaptail learned that there were no fish to be found in the marsh, and that the marsh was full of scum and weeds.

Cause and Effect Relationships

Read pages 3 and 4. Then write your answers to these questions:

Why was Mrs. Pondslider leaving?

Why did the water hit Rosie in the face?

Why couldn't Mr. Slaptail see the stems of his hyacinths?

Why was Oscar Otterbee in Mr. Slaptail's pond?

Details and Supporting Ideas

A. Look at the picture on pages 22 and 23. In your own words, write down what you see. Tell who, where and what. Include as many details as you can.

B. Think of all the characters you can remember from the story. Then choose which one is your *favorite*. Tell why you like that character the best, giving as many reasons as you can.

My favorite character in the story, *Mystery of the Muddled Marsh*, is ______________. That is because ______________________________

Main Idea

A. Look at the yellow box at the bottom of page 3. Which sentence below best tells the main idea of this Grasshopper's Science Box? Fill in the circle by your answer.

○ I could use a cool glass of water right now!
○ Water helps us stay healthy.
○ We use water to keep ourselves clean.
○ Most water comes from things we drink.

B. Look at the Grasshopper's Science Box on page 14. Which sentence below best tells the main idea? Fill in the circle by your answer.

○ Water comes into the body through the mouth.
○ The kidneys are the body's waste treatment plants.
○ Water is very important inside the body.
○ Liquids inside our body, like blood, are made mostly of water.

Fact and Opinion

Facts are true. Opinions are what someone thinks, but they might not be true. Tell whether you think each of these sentences from the story states a fact or an opinion. Write **F** or **O** in each space. *(Look back in the story if you need to.)*

_____ Paper boats will get soggy and sink in a minute. *(pg. 1)*

_____ When Beaver Pond gets too full, the water backs up into the marsh. *(pg. 9)*

_____ Almost everything on earth depends on water. *(pg. 14)*

_____ Riff is a "Mr. Know-It-All." *(pg. 14)*

_____ Natural spring water comes right out of the ground. *(pg. 16)*

_____ An ugly, gasping monster staggered up the hill. *(pg. 19)*

_____ The tractor took off without Mr. Otterbee. *(pg. 20)*

_____ When it rains, loose soil and fertilizer run into the creek. *(pg. 23)*

_____ This boat will win for sure. *(pg. 30)*

Following Written Directions

Follow the directions on page 32 to make a paper boat. Work with a partner to make a boat together the first time, and then make and decorate your own boat.

Summarizing

A. Read pages 5 to 7. Pretend you are Riff, visiting your cousin Rosie. Write a short note to your family at home, telling them what happened today. *(Describe what happened only on pages 5 to 7.)*

B. After you have read the whole story, list 5 things you have learned that people can do to keep our water supply safe and clean.

1. ______
2. ______
3. ______
4. ______
5. ______

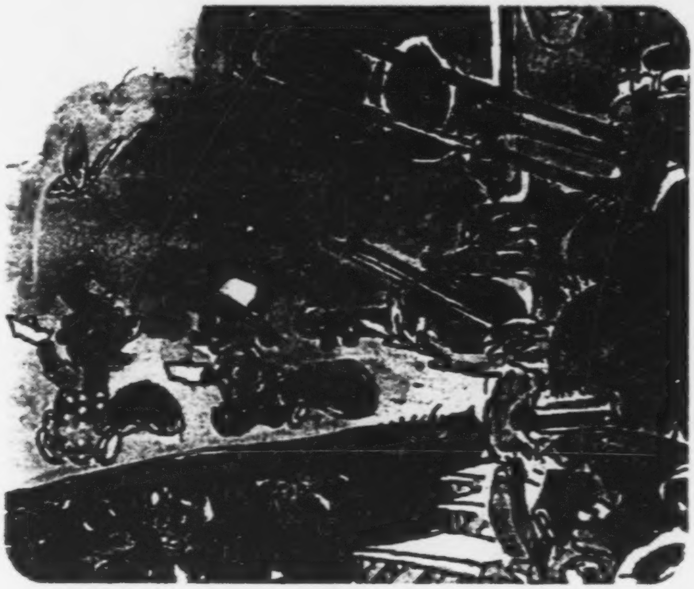
Inferences/Generalizations and Conclusions

A. Fill in the circle by the word that shows how each character felt:

1. How did Mrs. Pondslider feel when she said, "We can't live here anymore!"?
   - ○ happy
   - ○ curious
   - ○ sad
   - ○ excited

2. How did Riff feel when he said, "What are they talking about? Creeks don't die."?
   - ○ happy
   - ○ lucky
   - ○ sad
   - ○ confused

3. How did Mr. Slaptail feel when he said, "We worked hard to fix the park, and our water is clean again, so everyone can live here!"?
   - ○ happy
   - ○ angry
   - ○ sad
   - ○ afraid



B. After you have read *Mystery of the Muddled Marsh,* decide whether you think each of these sentences is True or False. Mark **T** or **F** on the line by each sentence. If you decide a sentence is false, rewrite it below to make it a true statement.

_____ Riff and Rosie do not care about the environment.

_____ The marsh became polluted because the people who live there were careless litterbugs.

_____ Even parks can be damaging to the natural environment, if they are not built and taken care of properly.

_____ Oscar Otterbee was trying to pollute the marsh to anger his neighbors.

_____ Once water becomes polluted, it can not be cleaned and will remain polluted forever.

_____ Many types of wildlife live in marshes because there is plenty of food and nesting places.

Rewrite False sentences to make them true:

Predicting Probable Outcomes

Think About It! What do you think will happen in Brightwater Corners after this story ends? How will the neighbors feel when the creek and marsh are healthy again? Do you think everyone learned something from what happened? Will life around the marsh be different from before? Write a paragraph, telling what you predict.

EALTH MY WORLD
ER AND MY WORLD

MYSTERY OF THE MUDDLED MARSH

RIFF AND ROSE

ritten by Barbara Tharp, Judith Dresden and Nancy Moreno
ustrated by T Lewis

My Health My World® Adventures

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WOW Publications
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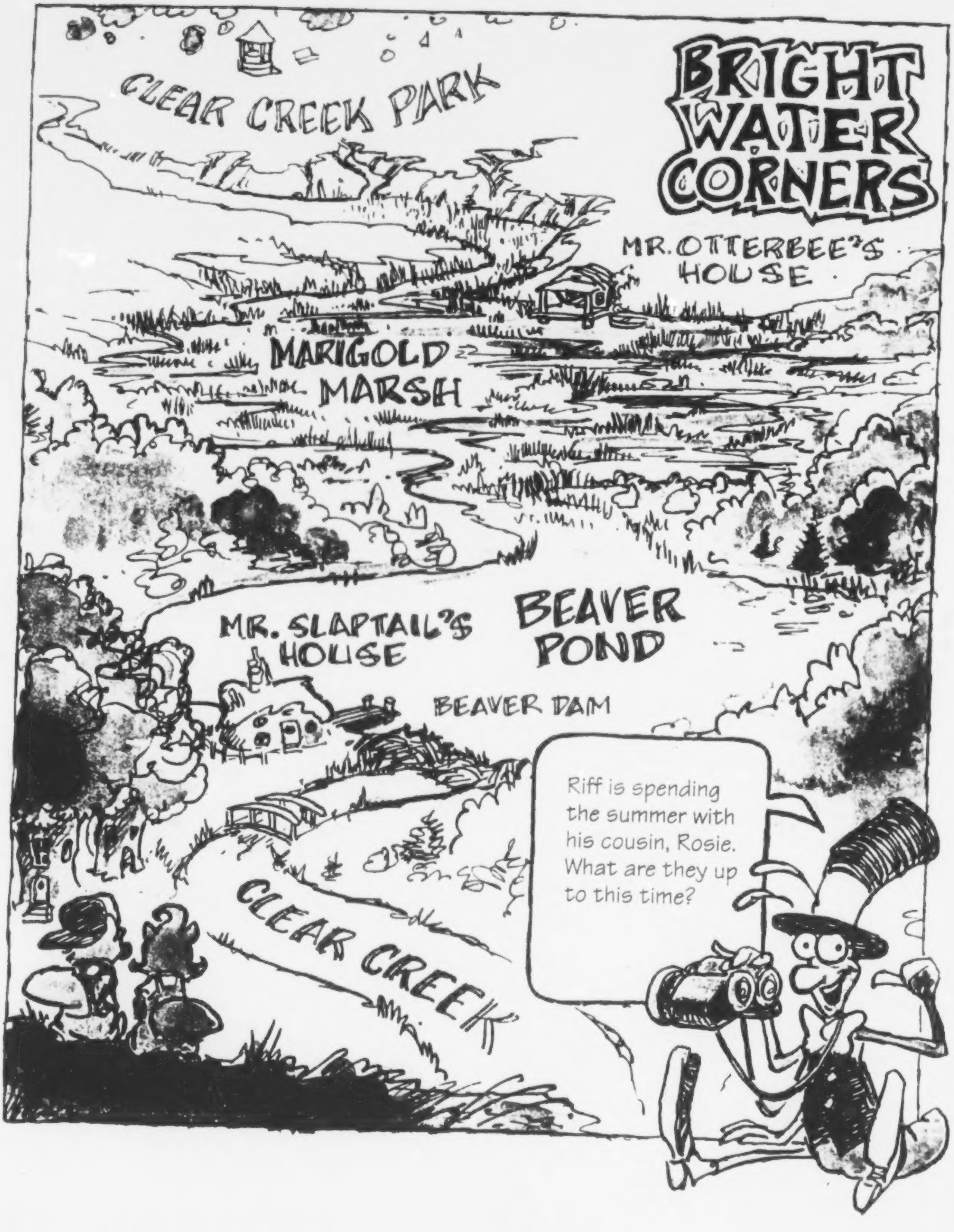
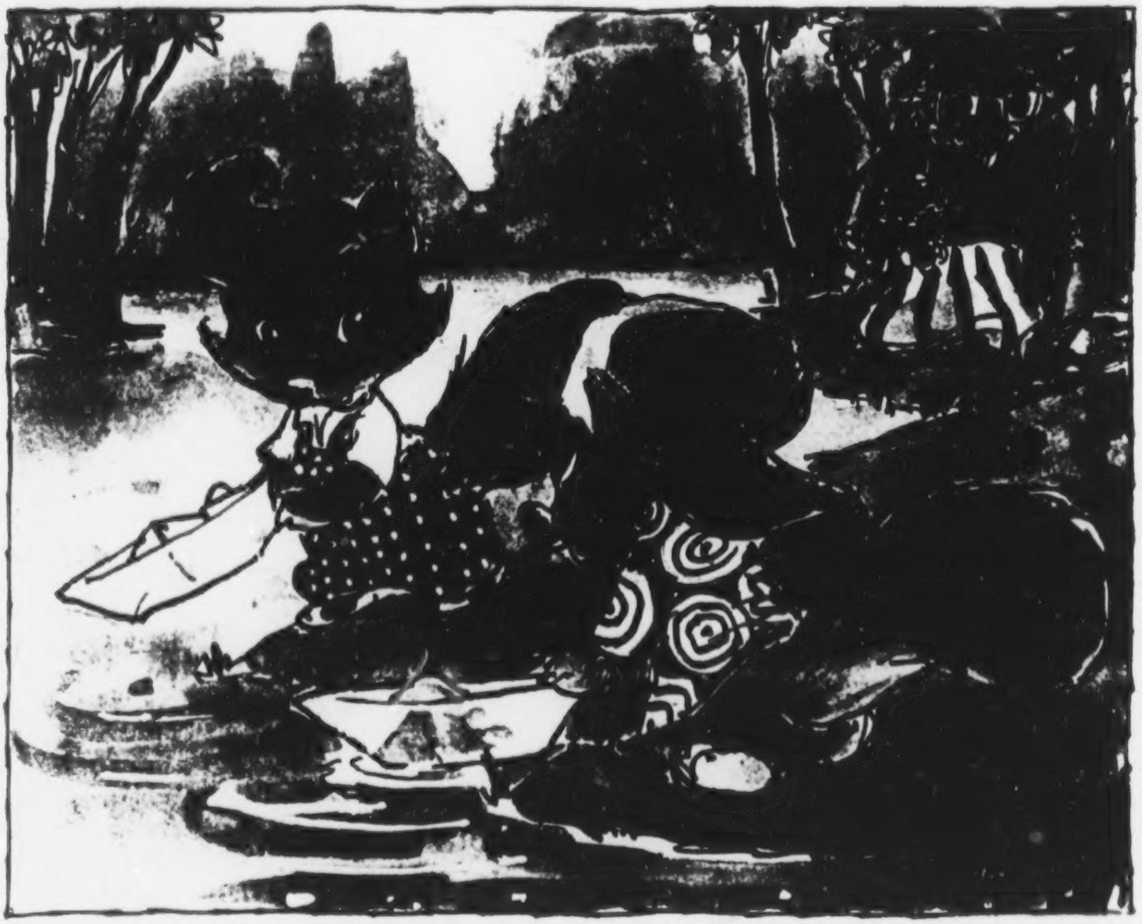
William Thomson, Ph.D., Co-Director
Judith Dresden, M.S.
Barbara Tharp, M.S.
Celia Clay, M.P.H.


BRIGHT WATER CORNERS
CLEAR CREEK PARK
MR. OTTERBEE'S HOUSE
MARIGOLD MARSH
MR. SLAPTAIL'S HOUSE
BEAVER POND
BEAVER DAM
CLEAR CREEK
Riff is spending the summer with his cousin, Rosie. What are they up to this time?



"Okay, let's see who's right this time," Rosie said to her cousin Riff. She set her boat down in the water and gave it a push.

"See what I mean?" she said. "Paper boats *can* float!"

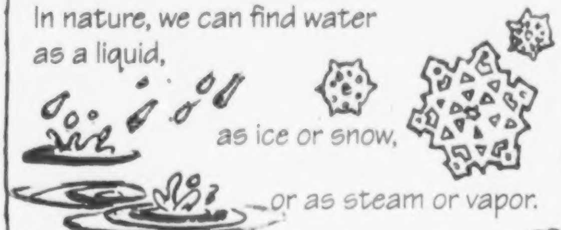
"I still bet they'll get soggy and sink in a minute," Riff answered.

"Uh-unh," Rosie argued. "Let's have a race. Bet mine will get across the pond before yours!"

What a cool pond!

Water is amazing. Most of our planet's surface is covered by water. Almost all of the Earth's water is salty. The tiny amount of the world's water that doesn't have salt is called fresh water. Fresh water is the only water that we can drink. This pond and the stream and marsh beyond it have fresh water.

In nature, we can find water as a liquid, as ice or snow, or as steam or vapor.



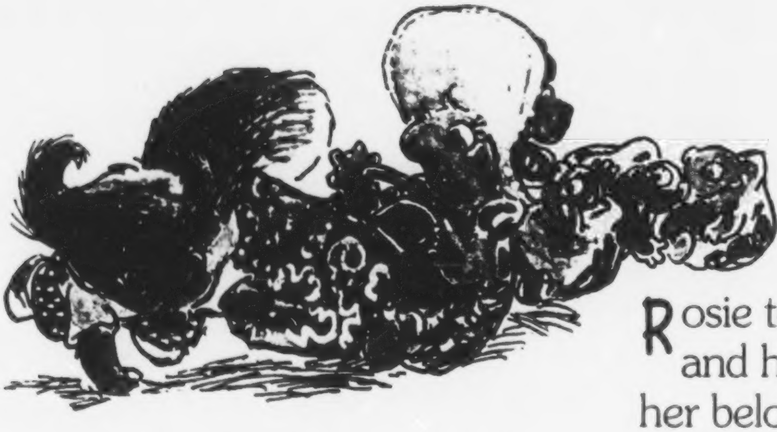
Many different things can dissolve in water.

A puff of wind caught the two boats, and off they sailed. Riff ran along the bank after them. He almost tripped over Mr. Slaptail, Rosie's neighbor who lived by the pond.

"Watch where you're going," Mr. Slaptail said. "You almost knocked me into the pond, and I already had my bath today! I'm trying to find enough water hyacinths for my salad."

"We're sorry, Mr. Slaptail," Rosie answered. "We'll get out of your way. Look! My paper boat is halfway across the pond already!"

Rosie turned and ran around the pond to catch up with the boats, and—WHAM! She crashed right into Mrs. Suzy Pondslider.

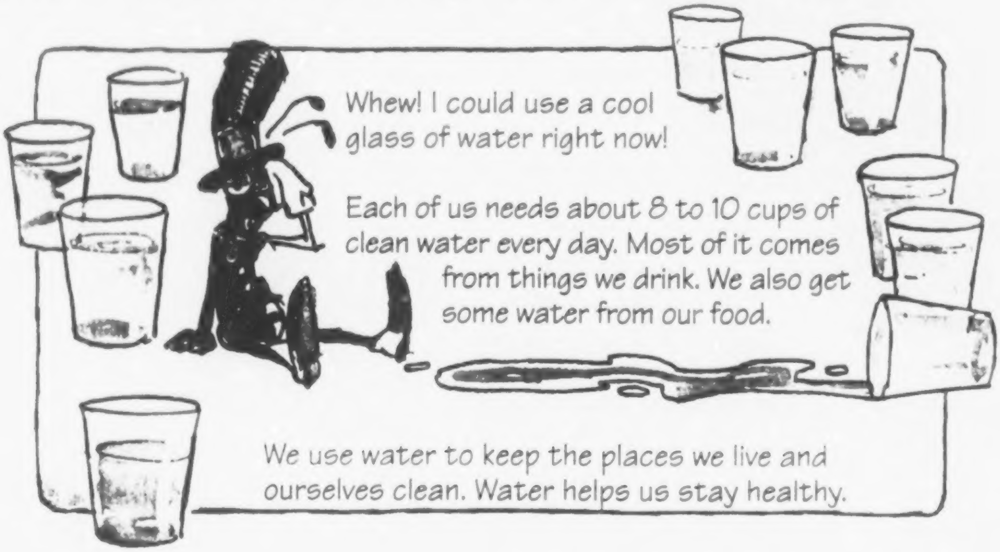


Rosie took a deep breath and helped Suzy pick up her belongings.

"Mrs. Pondslider," she asked, "what's the matter? Where are you going with all your things?"

"—The matter?! Haven't you noticed? The water is getting too shallow—and it smells bad, and I don't think we should be drinking it! I'm going to find a place with clean water, where my children will be healthy," Suzy Pondslider answered. "We can't live here anymore!" she said. Mrs. Pondslider marched across the dam with her children behind her, all in a row.

Rosie leaned down to look into the pond, and—splash!—the water came up and hit her in the face.

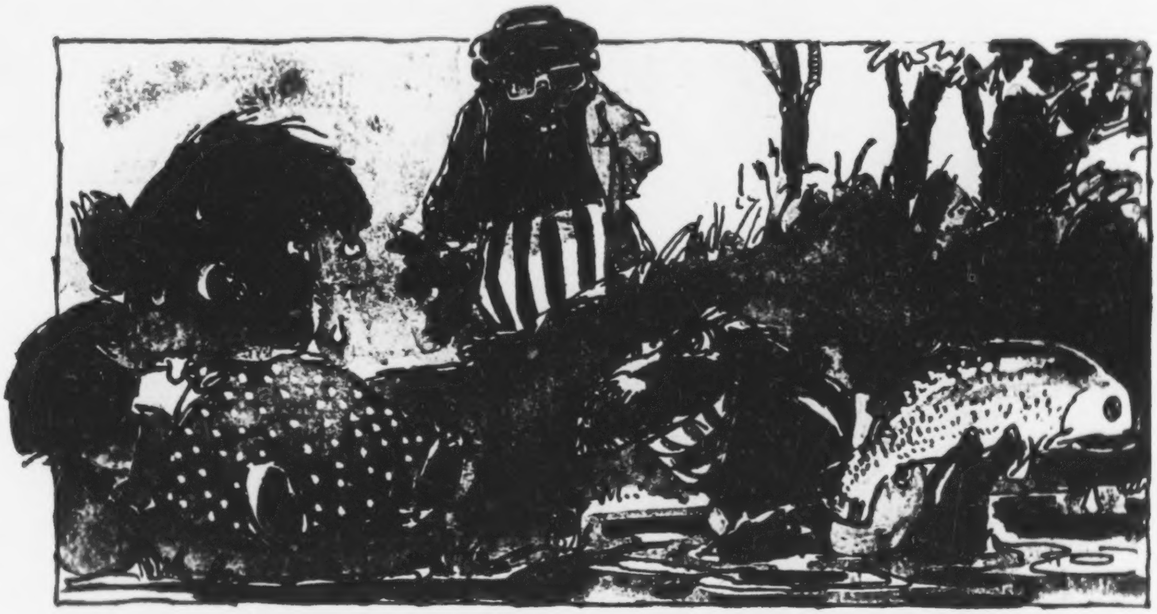

Whew! I could use a cool glass of water right now!

Each of us needs about 8 to 10 cups of clean water every day. Most of it comes from things we drink. We also get some water from our food.

We use water to keep the places we live and ourselves clean. Water helps us stay healthy.

"Hoo-hah! Watch out!" said a familiar, chuckling voice. It was Oscar Otterbee, who lived upstream near Marigold Marsh.

He twirled around and splashed the water some more.



"Otterbee! I should have known!" said Mr. Slaptail. "You're the one stirring up the water so I can't see the stems of my hyacinths! The water's gotten so muddy, I didn't even see you."

"Hoo-hah! You may be seeing a lot more of me!" said Otterbee. "Got a fish for my dinner! Nothing biting at *my* place but mosquitoes."

* * *

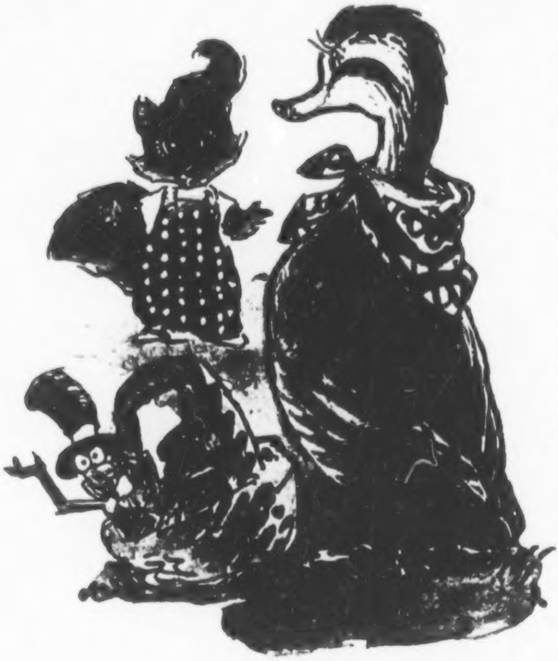
A big gust of wind came along and carried Rosie's boat across the pond. Rosie dashed after it. "I win! I win!" she shouted.

Before Rosie reached the other side of the pond, she came to a dead stop. Woody Duck, Ronnie Rail and Brenda Blackduck were blocking the way.

"You're going the wrong way, Rosie," Ronnie Rail said. "We're all heading south to Willow County. Maybe there we'll find something better to eat. There's not much left around here. Something is happening to our marsh."

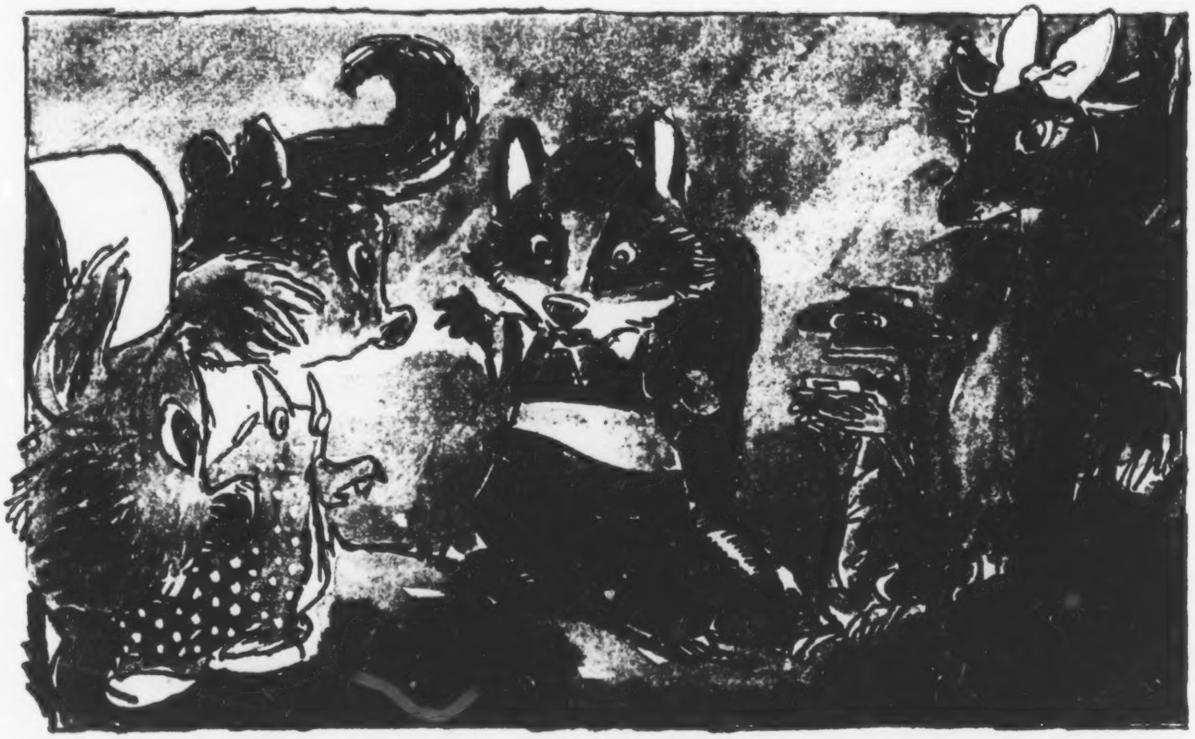
"But you've always lived here. You can't leave!" Rosie said.

"I'm afraid we have to," said Brenda Blackduck. "We can't live here anymore!" she said, and she walked away.



Rosie found Riff and told him the sad news of her friends. As they talked, they walked slowly away from the dam and up the stream.

Soon more and more neighbors came toward them. Each one was carrying a big bundle. Were they all leaving?



"Where are *you* going?" Rosie asked.

"No good fish left," moaned Ricardo Raccoon.

"No clean water to drink," said Dolores Deer.

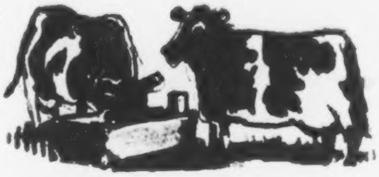
"Clear Creek isn't clear anymore," said Sully Salamander. "The water's like pea soup!"

"We can't live here anymore!" they all said together. "We think the marsh and the creek are dying."

"What are they talking about?" Riff asked. "Creeks don't die."

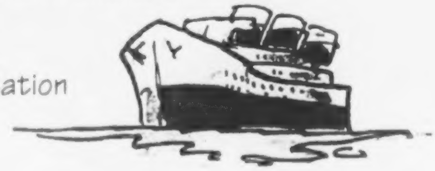
All the plants, animals and other creatures on earth depend on having clean water. Without it, there would be no life on our planet.

We use water in our homes for cooking, bathing and cleaning.



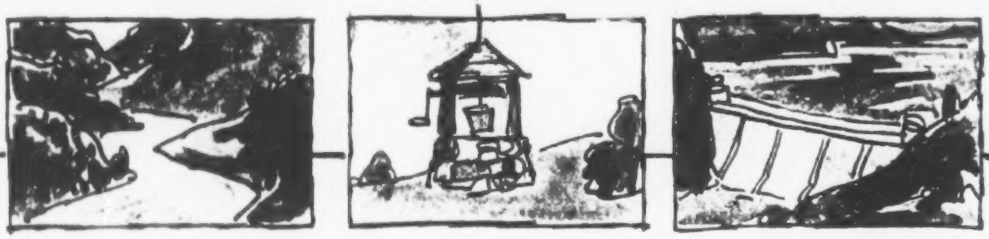
Water is important for growing crops and raising farm animals.

It often is used for transportation and to produce electricity.



Many factories use water for making products.

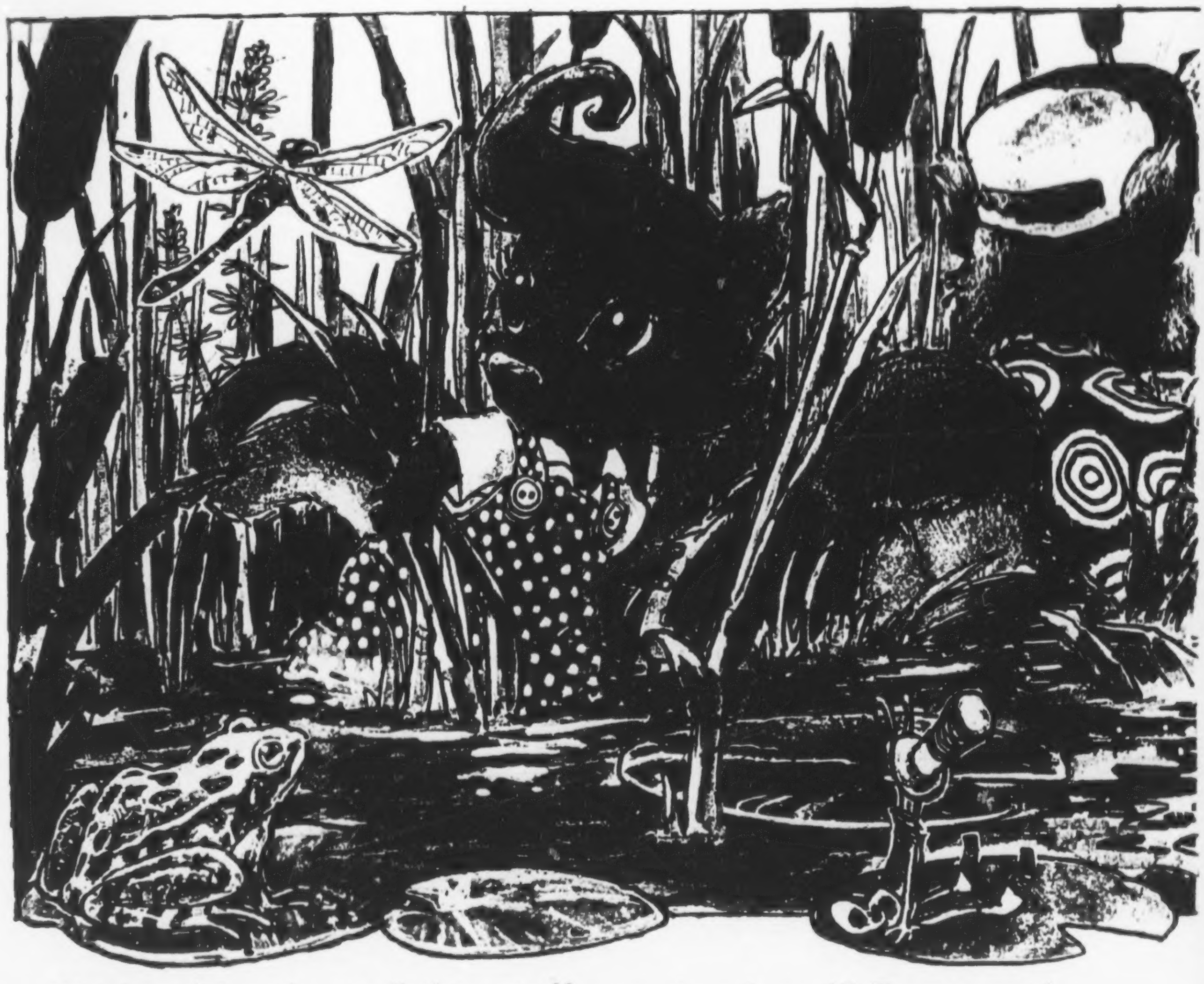
Where does the water you use come from?



"Come on, Riff," Rosie said, "let's go! We've got to find out what's wrong."

Riff ran ahead and disappeared around a bend. He called back to Rosie, "Wait until you see this! The creek disappears into a huge lake of tall grass!"

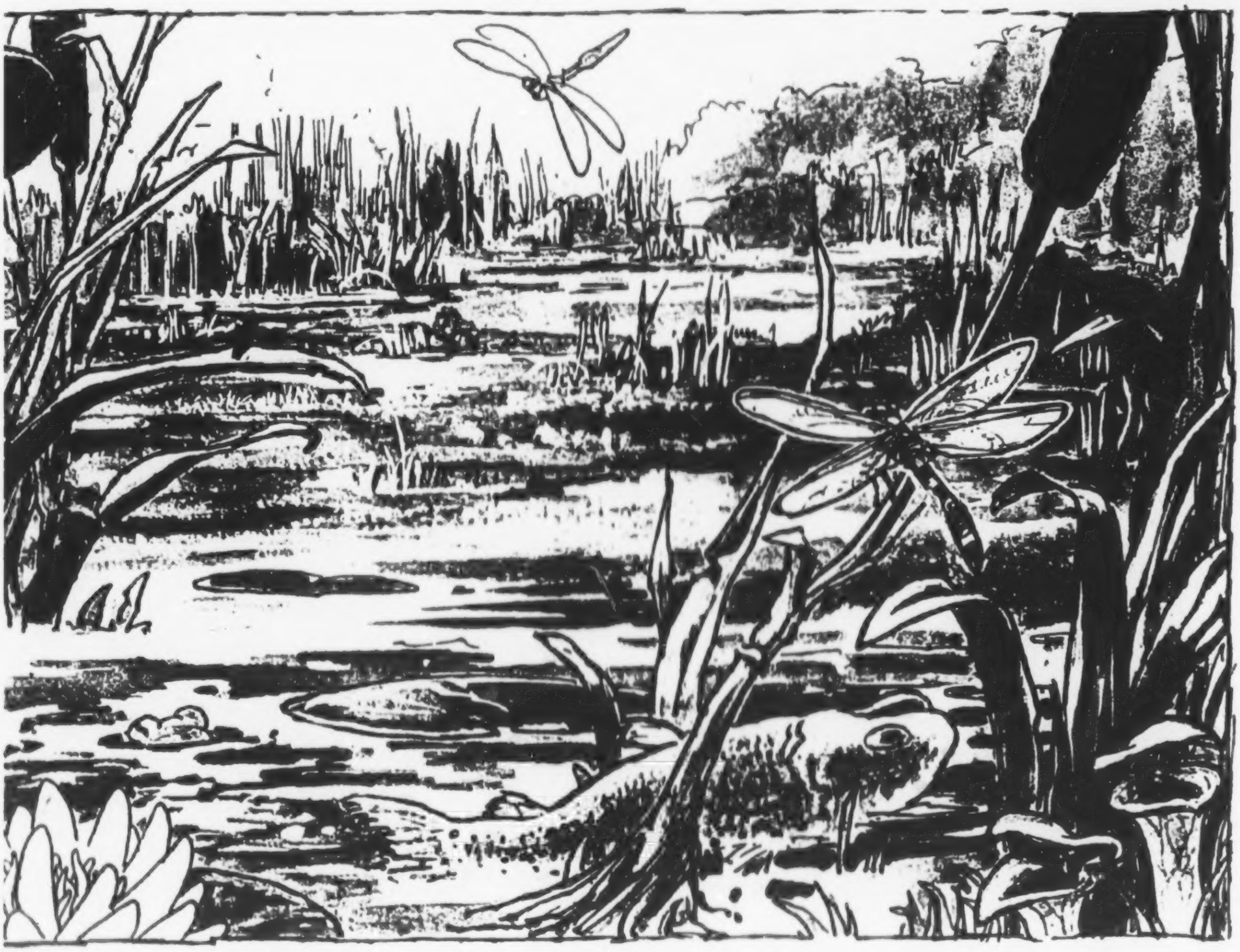
* * *



"Wow! Look at all this stuff growing here!" Rosie said, catching up with her cousin. "The water is almost gone, and what's left is covered with scum. No wonder they're leaving."

A worried Rosie slogged into the weed-choked marsh. Her feet kept sticking in the deep mud.

"What a mess! This is where the stream slows down and widens into Marigold Marsh," Rosie explained.



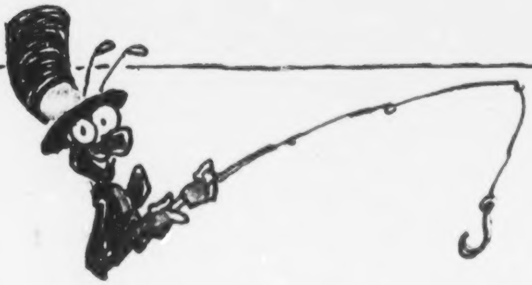
"When Beaver Pond gets too full, the water backs up into the marsh. All kinds of plants and animals used to live here."

"Now it's only full of weeds and mud," Riff added, "and . . . Yuk! There's a dead fish stuck in the cattails!"

"Hey, there's a school of little fish," cried Rosie, hopefully.

"But where are the *big* fish? Mr. Otterbee's right. I don't see any big ones at all," Riff said.

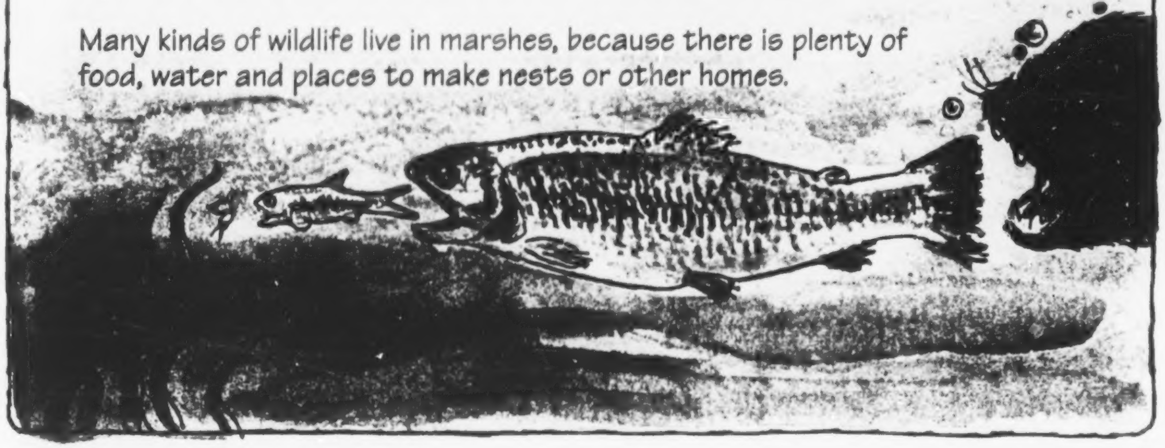
* * *



This marsh looks bad! Fish have a hard time finding food in murky, muddy water. When there aren't many fish to eat, other animals will be hungry too.

Marshes and other wetlands are important because they help make our water cleaner. They filter out some harmful chemicals and other materials. Wetlands act like giant sponges. They hold water that might cause flooding.

Many kinds of wildlife live in marshes, because there is plenty of food, water and places to make nests or other homes.



Rosie and Riff walked on until the marsh narrowed and seemed to become a creek again. Suddenly they spotted Mr. Otterbee in front of his house.

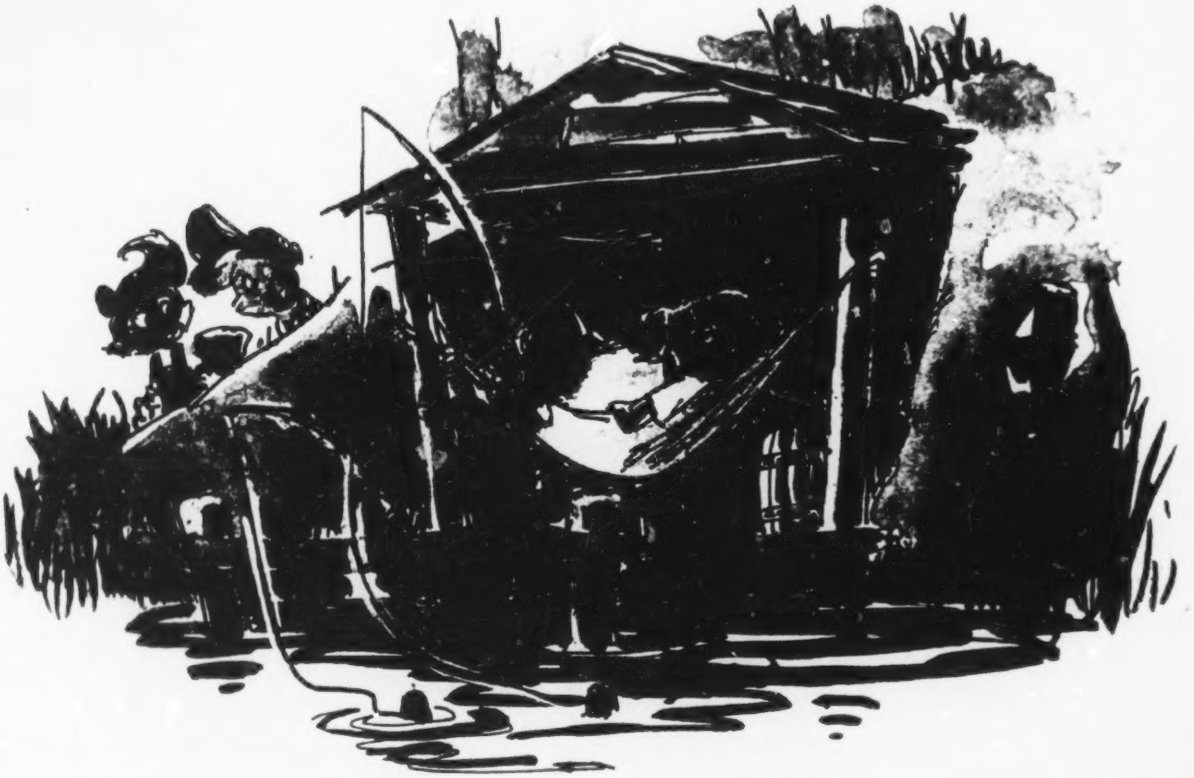
"How did you get here so fast, Mr. Otterbee?" Rosie asked him.

"Never waste time. Came right home and ate my fish," Mr. Otterbee said. "Got to check my line here, just in case," he added, with little hope in his voice.

"You're still fishing?" Riff asked. "Look at this place! Weeds are choking out everything."

"Never seen anything like it," Mr. Otterbee grumbled, shaking his head.

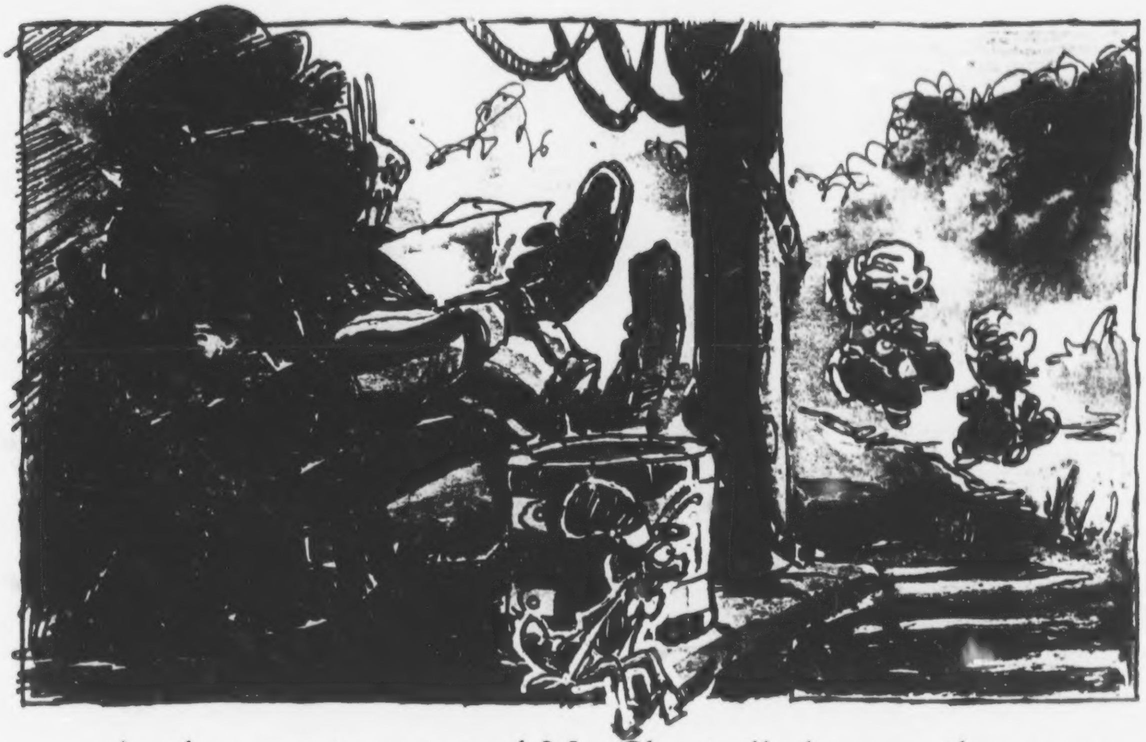
"We ran into a lot of our neighbors on the way over here. They're leaving," Rosie announced. "They say they can't live here anymore. What's going on?"



"Beats me! Been here all my life, and now, all of a sudden, things are changing," Mr. Otterbee said. "Bad news! Guess I'll have to become a vegetarian—or move in with old Slaptail to fish in *his* pond! Hoo-hah!"

Otterbee looked up at the sky and said, "Getting late. You'd better turn around. Marsh can be a scary place at night."

Riff and Rosie decided Mr. Otterbee was right. They *were* far from home. They headed back downstream.



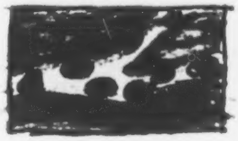
As the cousins passed Mr. Slaptail's house, they saw him sitting on the back porch.

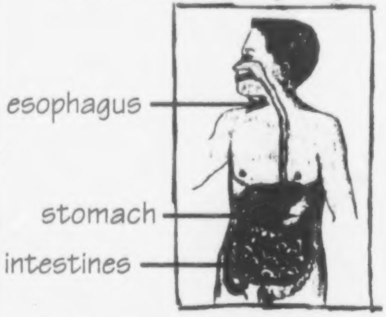
"We need your help," Riff called to him. Both talking at once, Riff and Rosie told Mr. Slaptail about all they'd seen. They asked him to go with them in the morning to take a look.

"What do you think could be happening?" Rosie asked. Mr. Slaptail only gazed out across the dam, frowning, but not saying a word.

* * *

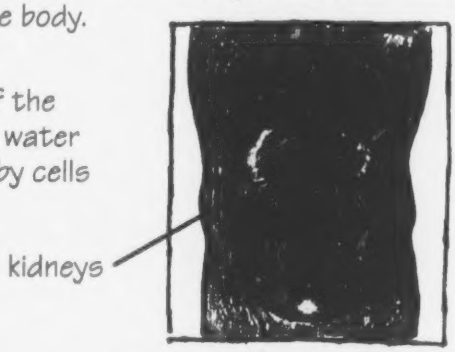
The human body is almost $\frac{3}{4}$ water. Liquids inside our bodies, like blood, are made mostly of water. There even is water inside every tiny cell.





Water comes into the body through the mouth. When we swallow, it goes down the esophagus to the stomach. From there it passes into the intestines. The intestines are where most water is taken into the bloodstream, along with food needed all over the body.

Water is very important inside the body. All of the materials needed by cells are dissolved in the water part of our blood. The waste materials made by cells also are dissolved in the blood.



The kidneys are the body's waste treatment plants. They filter wastes from the body, making urine.

Riff was up early the next day, collecting his gear for the marsh expedition. "Rosie," he said, "I've been thinking. All our friends' problems seem to be about water. Did you know that almost everything on earth depends on water? This is definitely a *water* problem!"

Rosie looked at her cousin with a raised eyebrow. "Well, Mr. Know-It-All—bet you didn't know that *you're* mostly water, yourself!" she said. "Come on. Let's go see if Mr. Slaptail is ready."

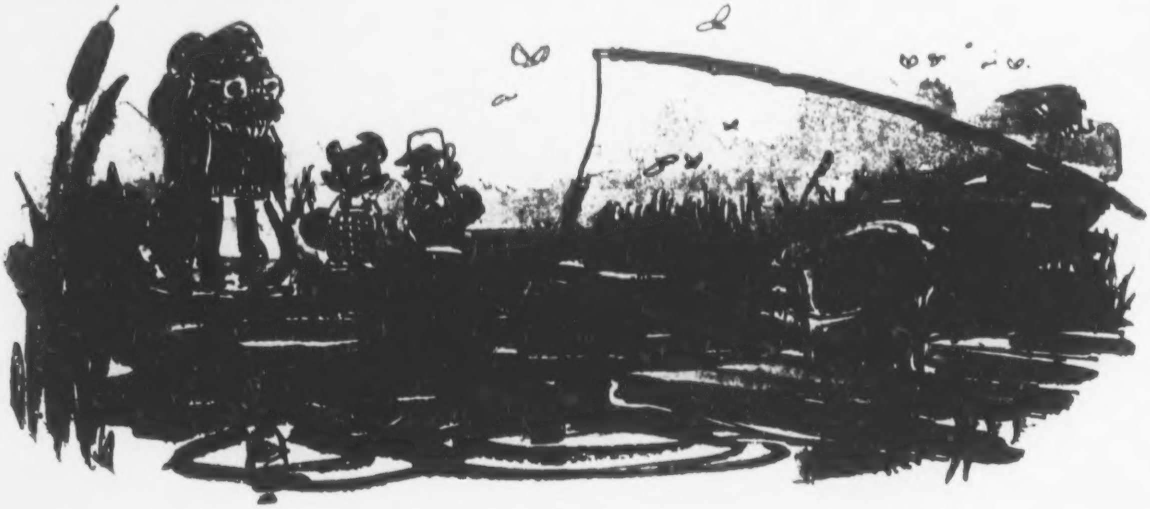
They found Mr. Slaptail on his dock. Soon the three of them left the pond and headed up the stream.

Mr. Slaptail looked around and said, "It's been a long time since I was up here. Folks used to do a lot of fishing in this part of the creek. There were catfish, sunfish and bass—so many kinds of fish!"

"But where are they now?" Mr. Slaptail said, his voice rising in alarm. "And where did all the nasty weeds and scum come from?!"

"See? We told you!" said Rosie.

Rosie, Riff and Mr. Slaptail slowly made their way upstream. They reached Mr. Otterbee's house and saw his fishing line hanging limply in the water. Insects were buzzing around, but there was no sign of Otterbee and no fish to be seen.



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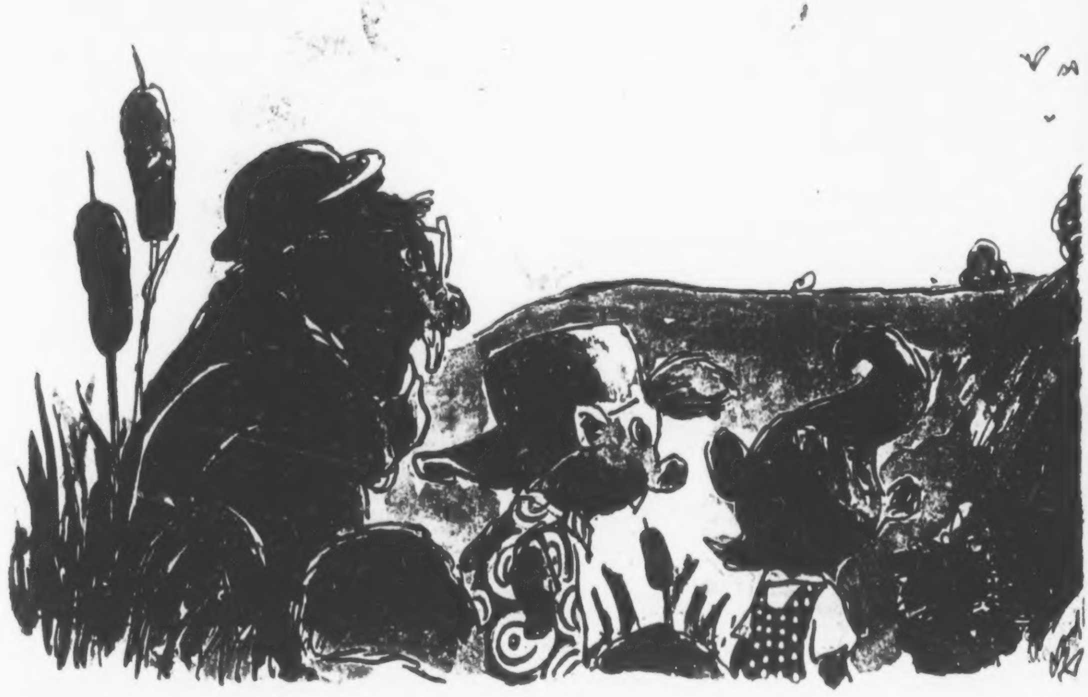


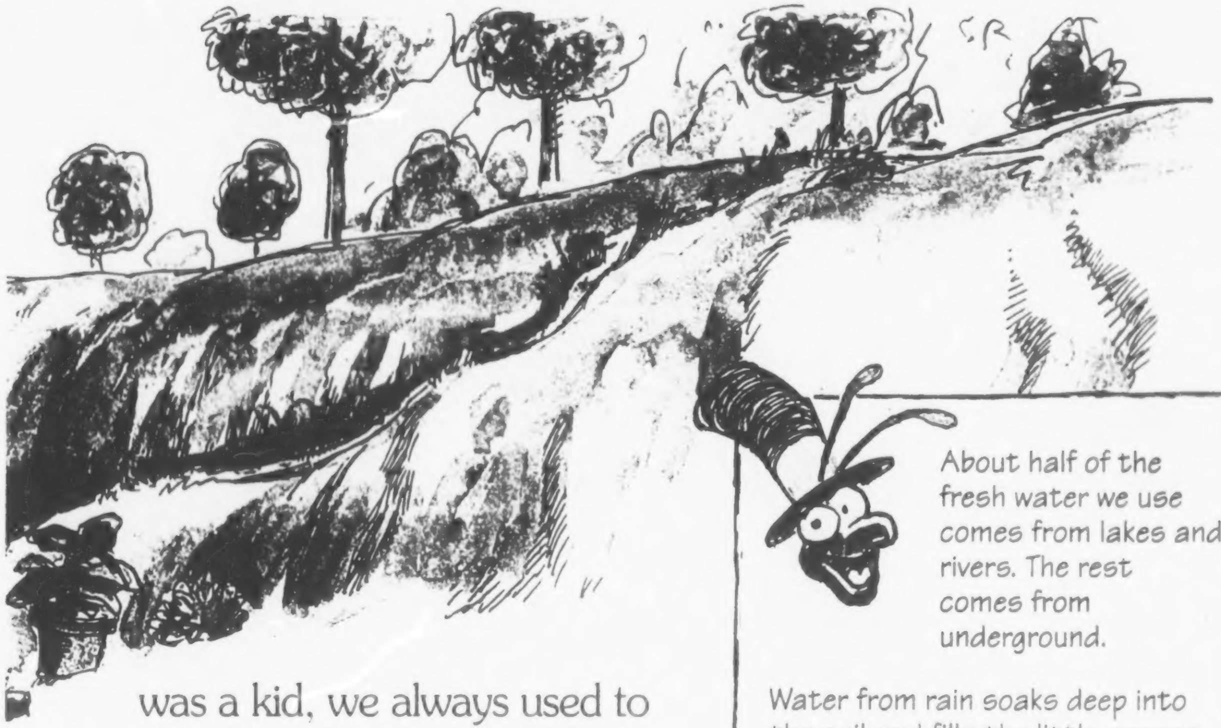
They trudged farther up the stream. Suddenly Rosie stopped, and her mouth dropped wide open. Something was very wrong.

"What happened here?" Rosie asked.

"What a mess! The bank of the stream has been scraped clean! And look at these plants in pots!" Mr. Slaptail exclaimed. "I've never seen plants like this around here."

Rosie walked up a little hill covered in new grass. She found a small pool and peered into it. "How pretty! The water is really clear in here," she said, "but look–it has green stuff growing in it too!"

"That pool comes from a natural spring. The water comes right out of the ground," Mr. Slaptail said. "When I



was a kid, we always used to stop here for a nice cool drink. I wouldn't dare to do it now."

"What kind of place *is* this?" Riff asked. "There's no good water to drink, no berries to eat, no fish to catch .... Even these plants are strange!"

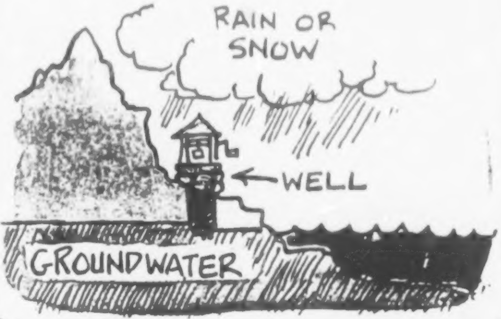
"*I* know! This must be the new park," Rosie exclaimed. "We heard about it at school—but I didn't think it would be like this. It gives me the creeps!"

* * *

About half of the fresh water we use comes from lakes and rivers. The rest comes from underground.

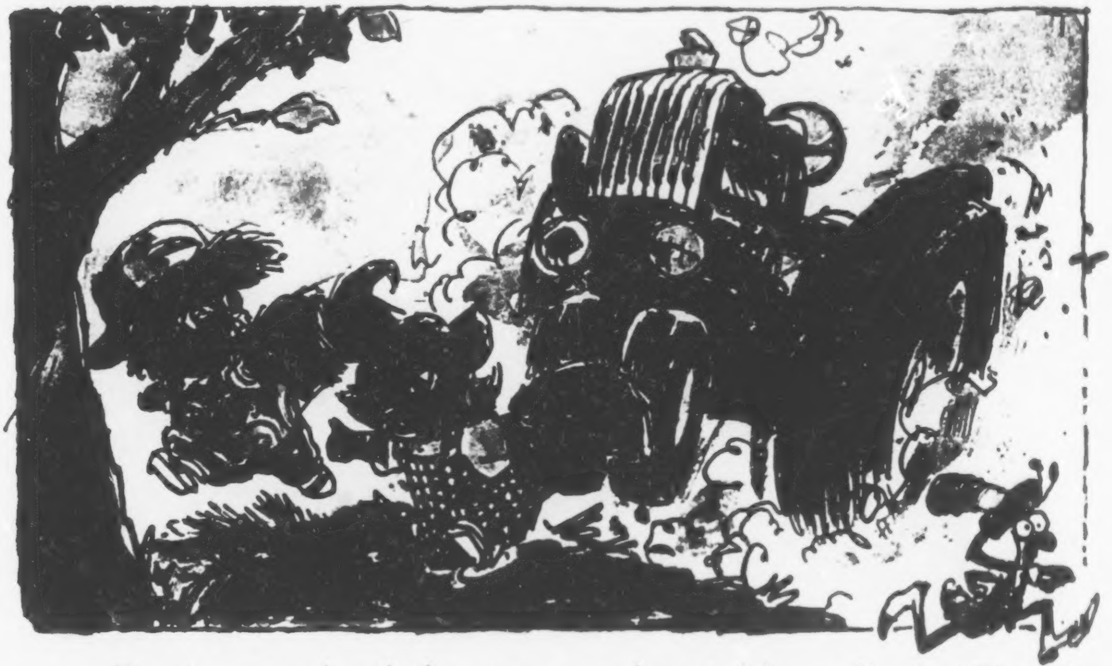
Water from rain soaks deep into the soil and fills the little spaces between pieces of sand and rock. We can find this water by drilling wells. When the water is near the surface, sometimes it flows out and makes a spring.

Groundwater can be polluted by harmful chemicals that soak into the soil with rainwater.



Suddenly, a roaring noise filled the air. It got louder and louder. Riff raced past Rosie and headed up the hill to see what it was.

"Wow! Wait 'till you see this," Riff shouted. "There's a gigantic red machine coming straight up the hill!"



Rosie reached the top and quickly yelled, "Don't just stand there, Riff! It's a tractor—and nobody's driving it! Run!"

They headed for a big tree. As they frantically began to climb, the tractor roared up over the hilltop. Dust and seeds were flying everywhere.

"Hold on! It's headed straight for this tree," Riff hollered. They both wrapped themselves firmly about a big, sturdy branch.

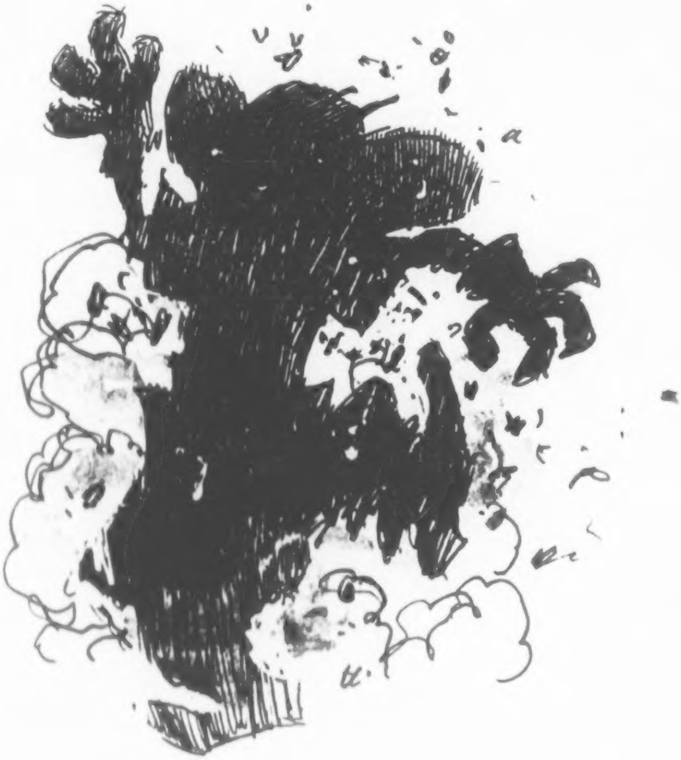
Crash—BOOM! The tractor hit the tree with the force of a giant—and then stopped.

When Riff and Rosie uncovered their eyes, they saw the runaway tractor below them. But there was something even worse. A creature was staggering up the hill in a cloud of dust—an ugly, gasping monster!

Mr. Slaptail finally puffed his way to the top of the hill. "Rosie! Riff! Are you okay?" he shouted. "What in the world?! . . ."

"Aargh—Aaa-aachoo-waah," the monster spewed and spluttered. It staggered closer to the tree.

* * *

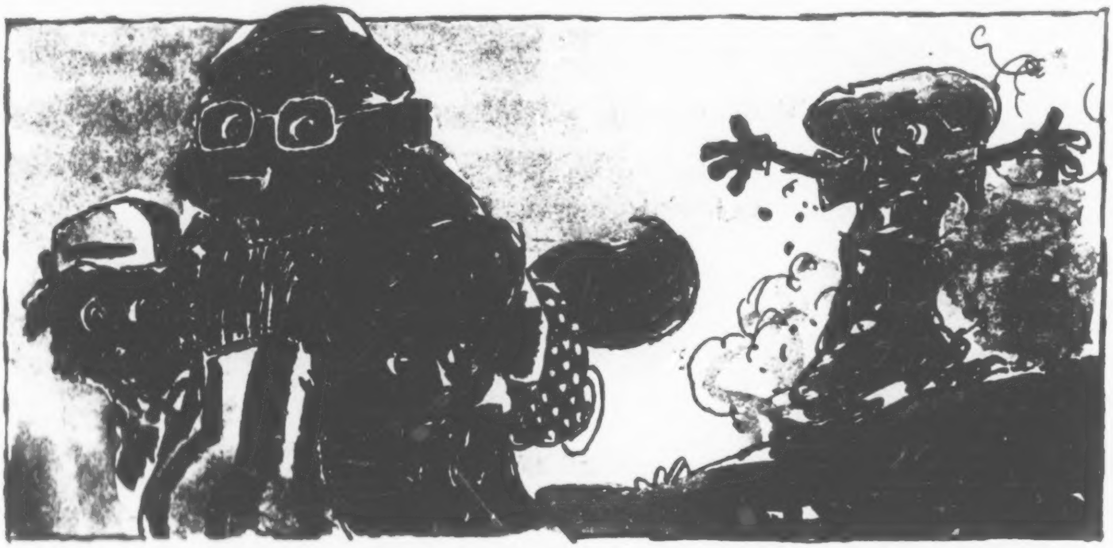


Mr. Slaptail grabbed Riff and Rosie, one under each arm, turned and headed down the hill.

"Wait! It's me, Oscar. Oscar Otterbee," the monster gasped.

Mr. Slaptail stopped and looked again at the strange creature.

"It's *me*," Otterbee explained again. "That new power tractor took off without me. I was putting in the last bag of grass seed and—POW—it kicked into gear! Been running after it for a mile! Now look at it. It's a mess!"



"And so are *you*, my friend!" Mr. Slaptail said. "I didn't even know you."

"You really scared us, Mr. Otterbee!" Rosie added.

"Yep, you're about the scariest looking thing I've seen in a long time!" Mr. Slaptail added. A grin crept across his face.

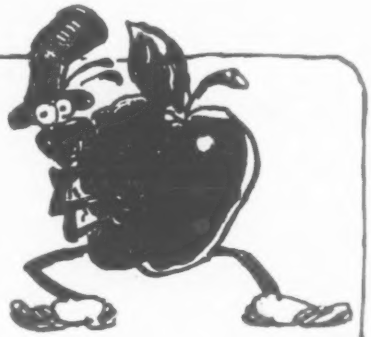
"Hoo-hah! Me?" said Otterbee. "Been called a lot of things before, but never scary!" Mr. Otterbee laughed for a minute with his friends, but his smile soon turned to a frown.

"Now I'm in big trouble," Otterbee moaned. "Look at this tractor! Got to finish seeding and then fertilize again. It's my job to get the park ready to open next month."

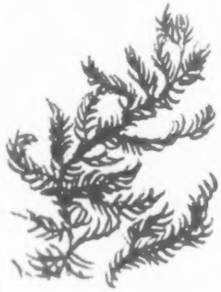
Rosie sneezed and then wondered out loud, "Hmm … fertilize? You're fertilizing all this new grass, and the flowers, and everything in the park? . . . Of course! It's making the new plants grow—but it's making other things grow, too."

"What's *that* got to do with anything?" Oscar Otterbee wheezed.

In addition to light, carbon dioxide and water, plants need nutrients to grow. Sometimes, we help plants by giving them extra nutrients. One way to do this is by adding fertilizers to the soil. Fertilizers make crops grow very well. The wise and careful use of fertilizer is important for producing food.



However, when rain washes extra fertilizers or rich soil into lakes and rivers, some water plants grow too much.



Other green things, like algae, also grow too much in the water.

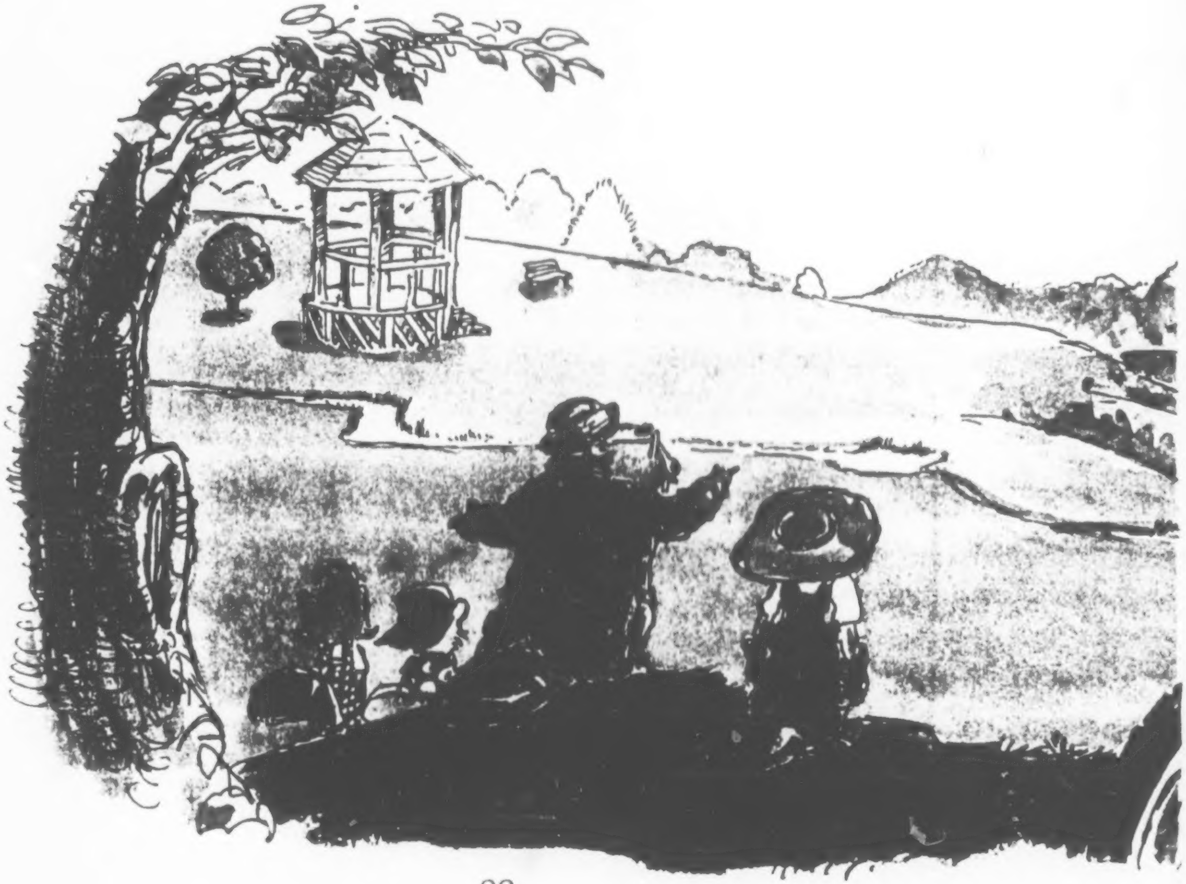
"Your fertilizer is running off into the creek and making the water plants grow *too* much," Rosie said.

"Dirt's washing into the water, too," said Riff, "and it's all choking out the stream."

"—and making the water scummy," Rosie said.

"—and making our neighbors leave," Mr. Slaptail added.

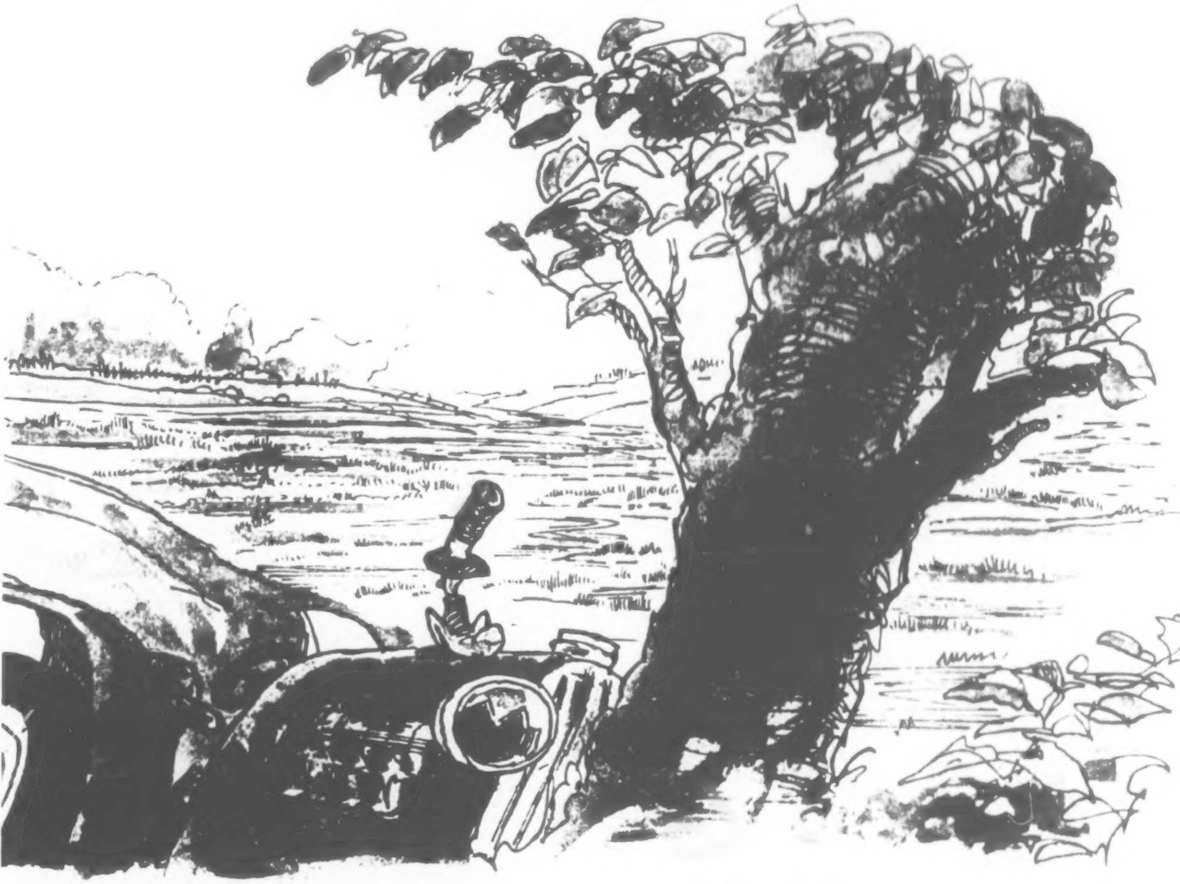
"Yes! That's it!" Rosie cried. "I think we've solved the mystery! You are polluting our stream and causing all the trouble, Mr. Otterbee," she said boldly.



"What?! I'm not polluting!" Mr. Otterbee snapped back. "I'm just trying to get my job done the quickest way I know how."

"Oscar, you just don't understand," Mr. Slaptail said. "Don't you see? It's the runoff. When it rains, the loose soil and fertilizer run into the creek with the water, and make all the plants *there* grow. Extra fertilizer even soaks way into the ground and pollutes the water that comes from the spring."

Riff scratched his head and said, "So the pool by the spring is growing green stuff, too. The creek is shallow and full of weeds ..."



Rain water washes off chemicals like fertilizers, spilled gasoline and insect sprays, and carries them into our waterways. These can be harmful to people and to the creatures that live in rivers and lakes.

On bare land, rain also washes bits of soil into rivers, lakes and wetlands. Washed-off soil can make the water in streams and lakes become muddy. It can make them too shallow for fish.

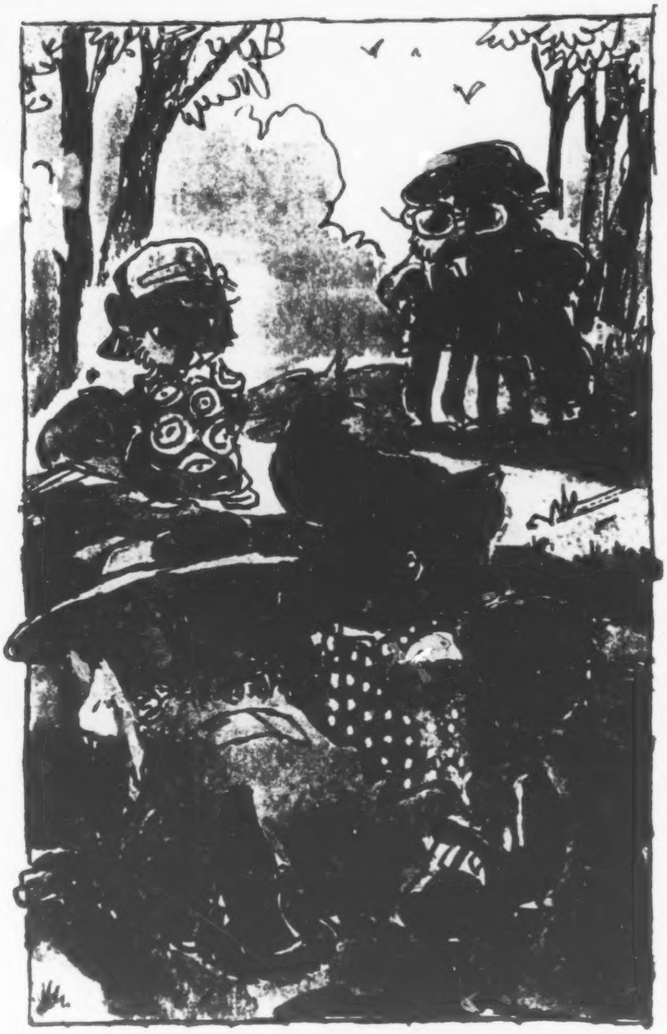
As plants and algae in a polluted marsh die, tiny bacteria in the water use them for food. The bacteria use up most of the oxygen in the water. This doesn't leave enough oxygen for fish and other water animals.

Pheweeee! This water even smells bad!

"—that choke out everything, and the fish can't get oxygen anymore, right?" Rosie finished.

"Ooh! Fertilizer went all the way down the creek and did all that damage? Who'd think of that?" said Otterbee. "So *that's* why I can't catch fish at my place anymore!"

"I'm afraid so," Mr. Slaptail said, "but I wish you'd stay out of *my* pond! You mess up my plants with your fancy flips and somersaults in the water."



“What a disaster! Guess I've ruined everything!” Mr. Otterbee groaned. “Ooh-waah . . . .”

“Wait a minute,” Rosie said. “It's not all your fault, Mr. Otterbee. It's everyone's fault. Everybody wanted to have a new park, but nobody thought about the problems it could make.”

“We'll think now,” Mr. Slaptail exclaimed. “All we have to do is get everybody together and try to do something about it.”

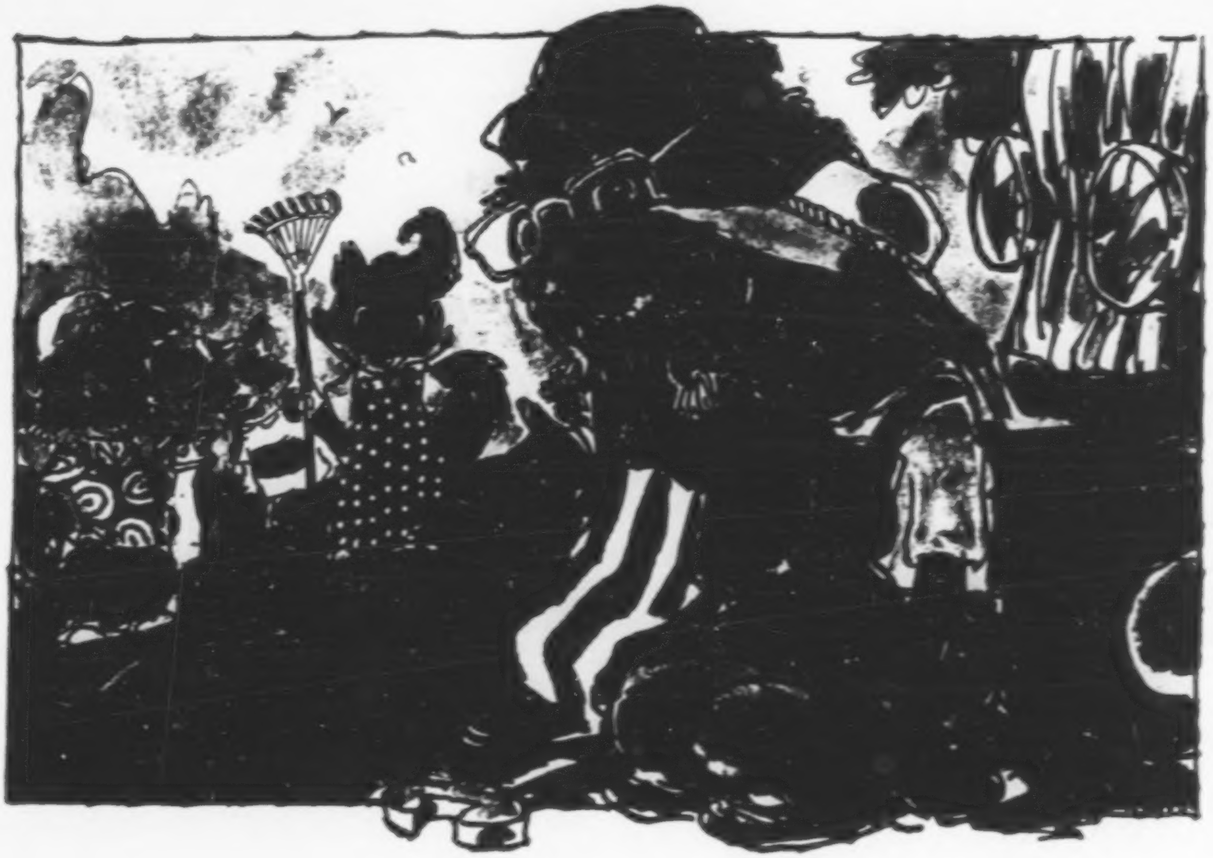
“But almost everyone has left,” Riff said.

“I'd better go find them,” said Mr. Slaptail, and he started off.

* * *

In the morning, Rosie and Riff joined Mr. Slaptail and all the neighbors he had found on their way out of town. They hurried to the new park. There was Oscar Otterbee, working on his tractor. He looked up sadly at his old friends.

"Sorry," Otterbee said. "Didn't mean to cause all this trouble. Thought I was doing the right thing. I just didn't know."



Water can be polluted in lots of different ways.
Did you know about these polluters?

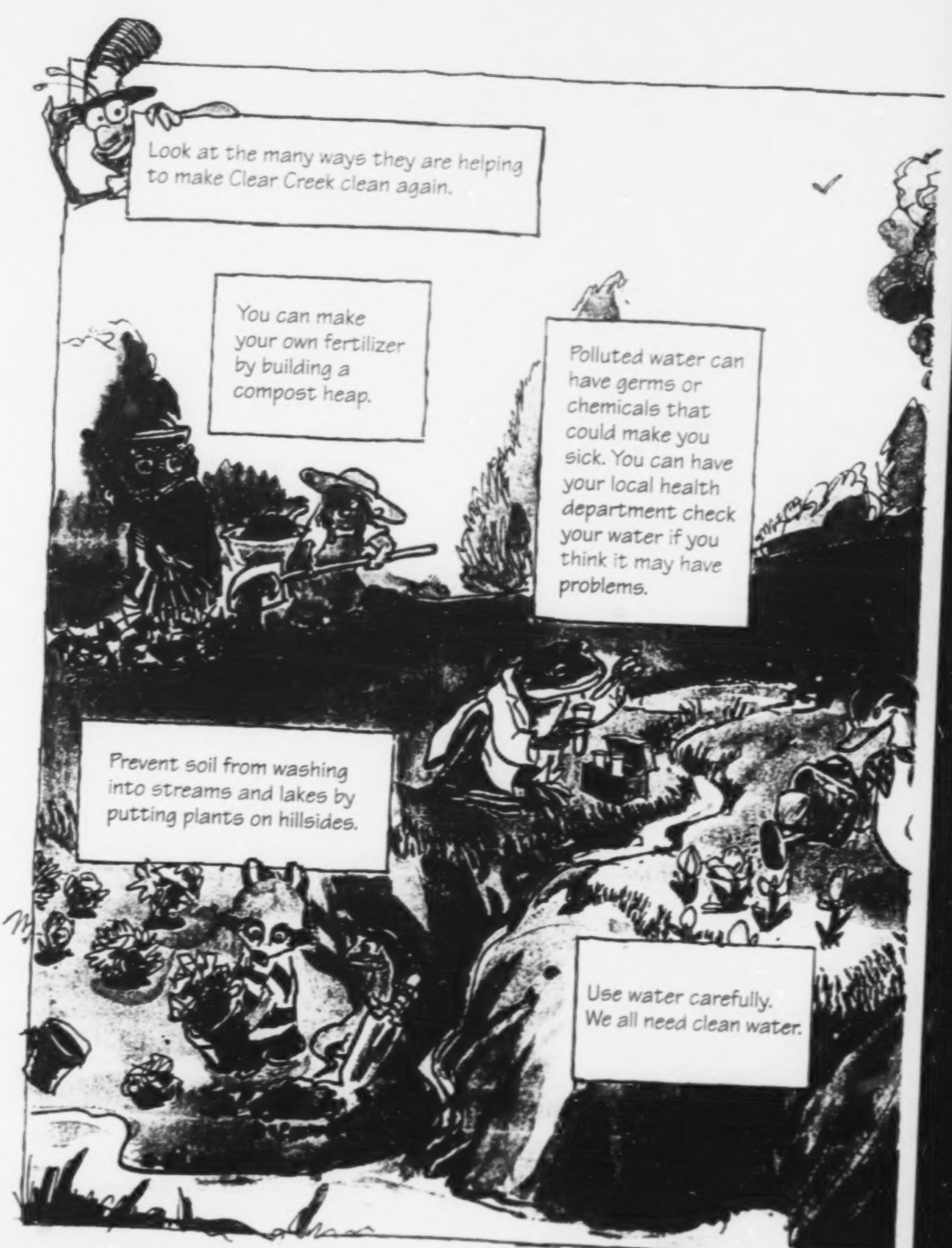
- sewage from houses and towns
- chemicals from factories and from our homes
- heated water from factories and electrical plants
- oil and gasoline from cars, trucks, boats and gas stations
- over-used fertilizers and pesticides
- washed-off soil

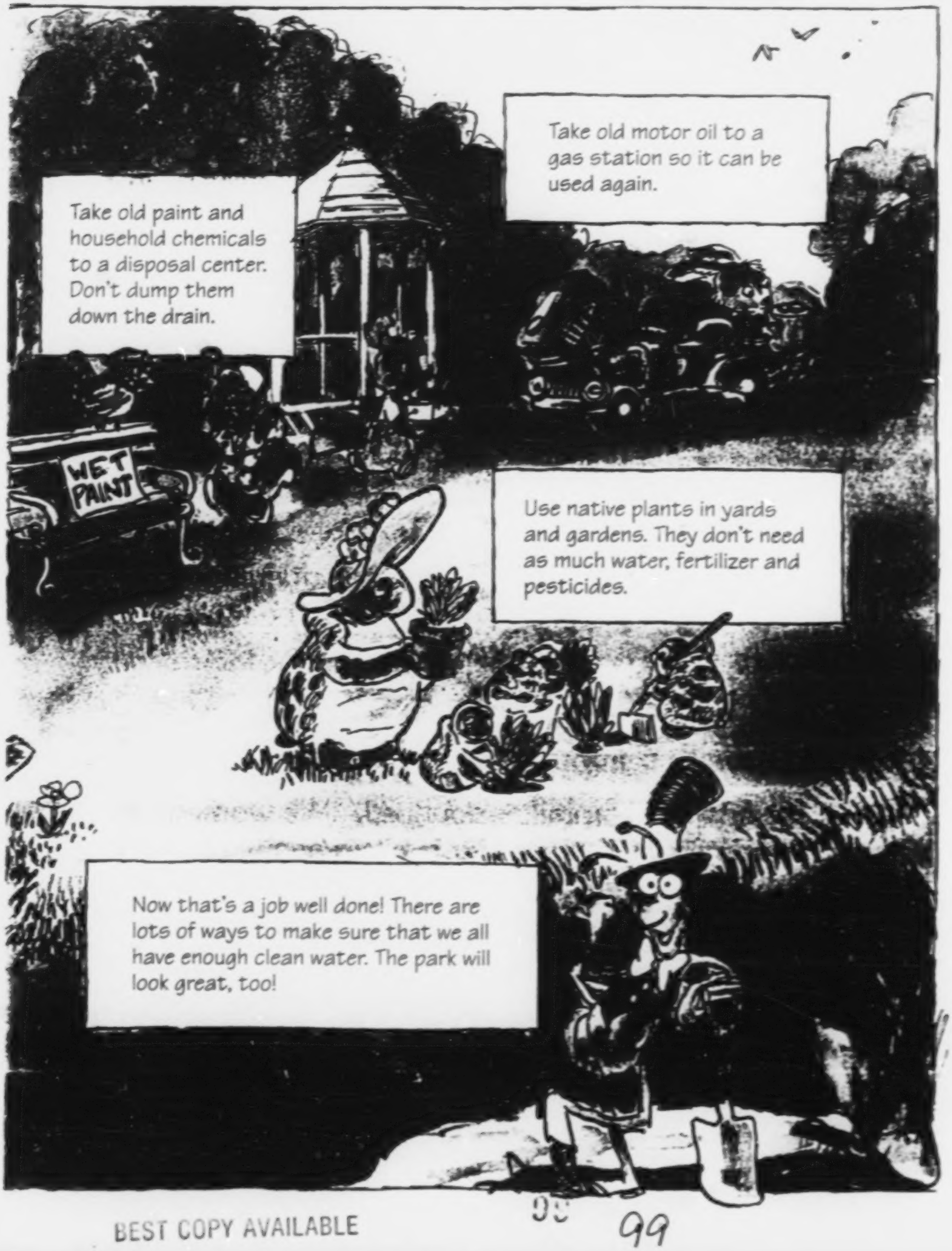
Mr. Slaptail gave his friend a pat on the back, saying, "It's okay. We'll finish it up somehow, *without* polluting."

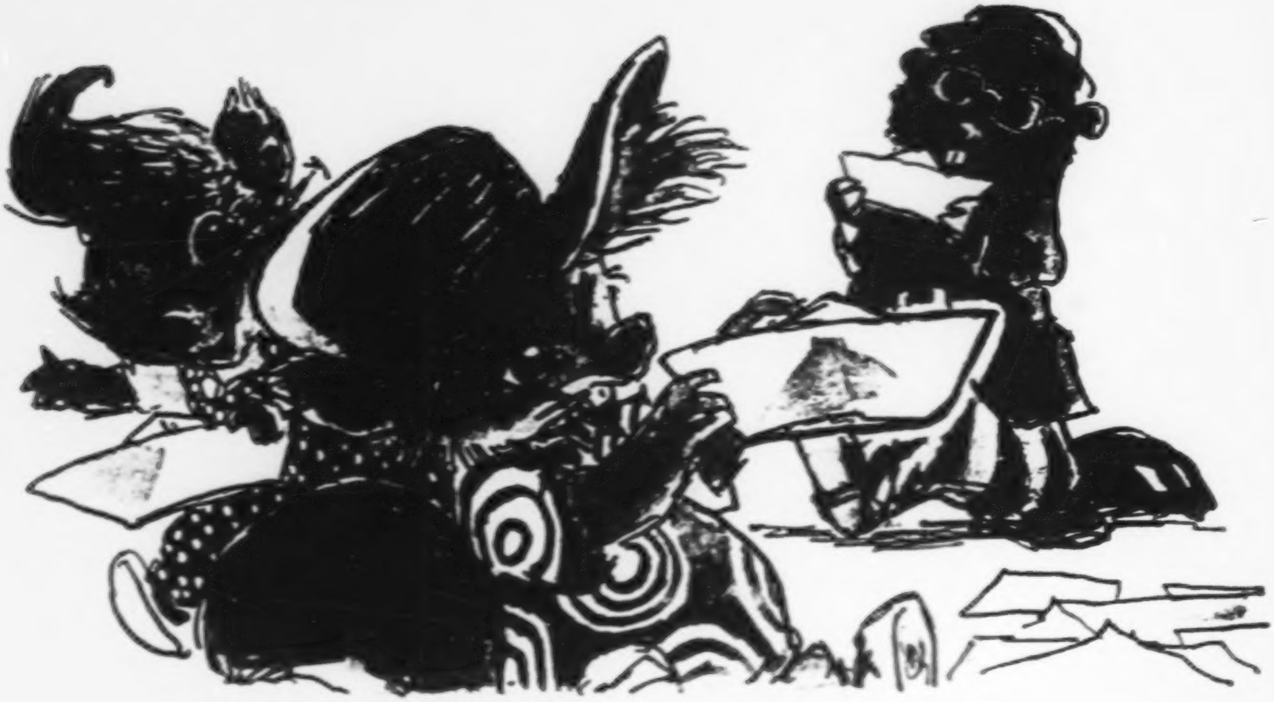
"Let us help!" everyone cried. "We'll find a way to clean up the water." "And save our homes!" "We'll all work together."

Rosie and Riff grinned, and Oscar Otterbee finally began to smile.

* * *


Look at the many ways they are helping to make Clear Creek clean again.
You can make your own fertilizer by building a compost heap.
Polluted water can have germs or chemicals that could make you sick. You can have your local health department check your water if you think it may have problems.
Prevent soil from washing into streams and lakes by putting plants on hillsides.
Use water carefully. We all need clean water.


Take old paint and household chemicals to a disposal center. Don't dump them down the drain.
Take old motor oil to a gas station so it can be used again.
WET PAINT
Use native plants in yards and gardens. They don't need as much water, fertilizer and pesticides.
Now that's a job well done! There are lots of ways to make sure that we all have enough clean water. The park will look great, too!

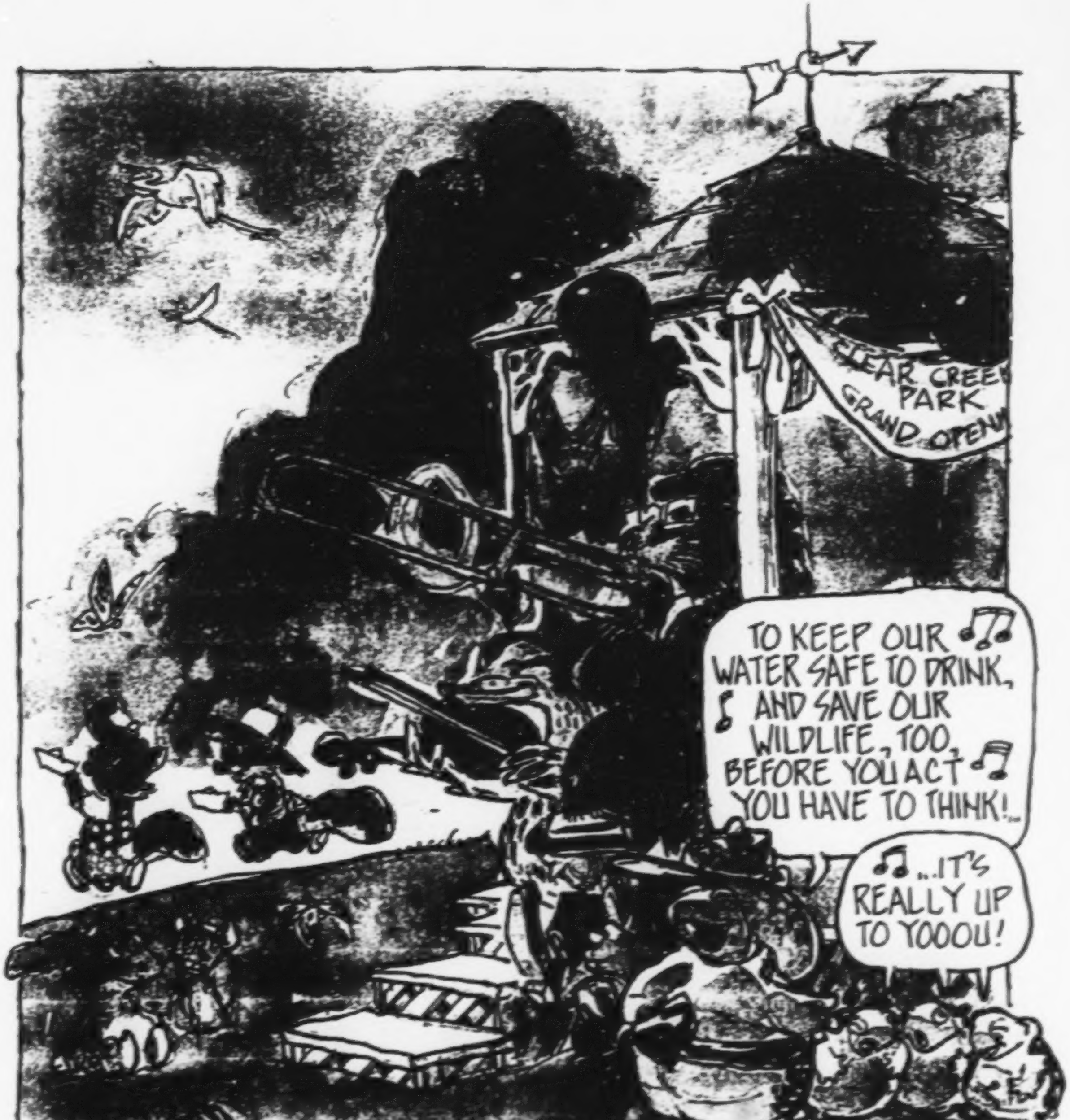


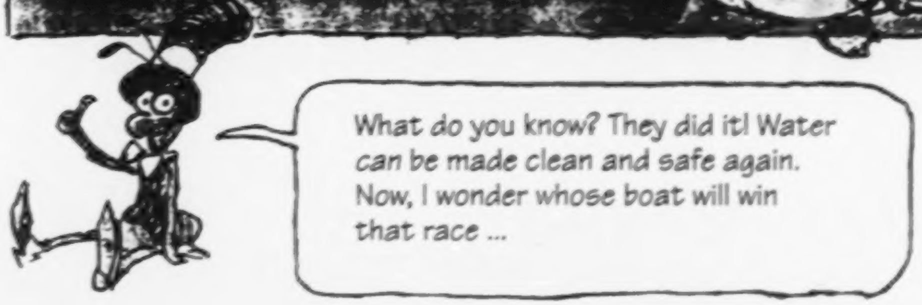
"Come on, Riff," said Rosie. "The park is opening today, and I want to be there for the first boat race."

"Okay, okay," Riff replied. "I'm almost finished. This boat will win for sure!"

"You'll have to beat mine!" Rosie said.

"I'm ready!" Mr. Slaptail announced. "We worked hard to fix the park, and our water is clean again, so everyone can live here! We deserve this celebration. Everybody does! Hurry up! It's time to go."


CLEAR CREE
PARK
GRAND OPENI
TO KEEP OUR WATER SAFE TO DRINK, AND SAVE OUR WILDLIFE, TOO, BEFORE YOU ACT YOU HAVE TO THINK!..
..IT'S REALLY UP TO YOOOU!


What do you know? They did it! Water can be made clean and safe again. Now, I wonder whose boat will win that race ...

How To Make A Paper Boat

Materials: $8\frac{1}{2}$ X 11 inch piece of paper; pencil or pen

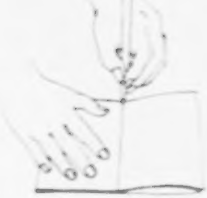
Other sizes in similar proportions will work, too: $9\frac{1}{2}$ X 12, $15\frac{1}{2}$ X 20, etc.

For best results don't use paper, like newsprint, that will absorb water quickly.

Procedure:

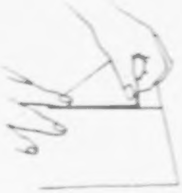
1. Lay the paper in front of you vertically on the table.

2. Fold in half, bringing the bottom half up to the top.

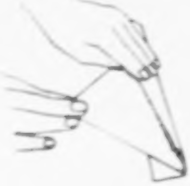


3. Now fold in half from left to right, crease, and open it back up to the first fold. With a pencil or pen, make a small dot at the bottom in the center of the paper.

4. Fold each of the bottom corners diagonally to the center crease.

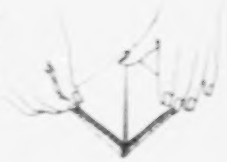


5. Fold the top flaps down (outward) over the triangle on each side.



Now you have a paper hat.

6. Pull the long sides of the hat outward, and flatten it down so that it becomes a square.

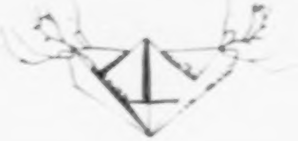


7. Fold the open corners back to the closed corners, making a smaller triangle.

8. Pull the long sides out again to make a smaller square.

9. Hold the square in your two hands, putting the point that has the dot at the top.

10. Take hold of the points at the top (next to the dot) and pull them outward to each side.



Now you have a boat, with a sail in the middle!

If you wish to make a smaller, sturdier boat, repeat steps 7 and 8 before opening out your boat in steps 9 and 10.

You may want to color or decorate your boat, or add a toothpick flag.

GLOSSARY

algae *(AL-jee)* - Plant-like organisms that grow in water or damp places.

bacteria *(bak-TEER-ee-uh)* - A kind of tiny organism that has only one cell. Some bacteria are helpful to living things and some cause diseases.

carbon dioxide *(KAR-buhn dy-AHK-syd)* - A gas made up of carbon and oxygen. You cannot see or smell it. It is given off by living things and when things burn or decay. It also forms the bubbles in soda pop.

cell *(SEL)* - The smallest unit of all living things.

dissolve *(dih-ZAHLV)* - When one chemical substance mixes completely with another.

filter *(FIL-tuhr)* - To strain something out of a liquid or gas.

groundwater *(GROWND-wau-tuhr)* - Water that sinks into the soil and collects underground.

ice *(iys)* - Frozen water. This is the solid form of water.

intestines *(ihn-TES-tihnz)* - Long, coiled parts of the digestive tube after the stomach.

kidneys *(KIHD-nees)* - A pair of organs in the lower back that separate water and waste products from the blood, and pass them out of the body as urine.

liquid *(LIHK-wihd)* - A substance that flows easily, can be poured, and takes the shape of its container. One of the three states of matter.

marsh *(mahrsh)* - An area of low, wet land covered by grasses and other small plants.

nutrient *(NOO-tree-uhnt)* - Any substance that an organism needs so that it can live and grow.

oxygen *(AHK-sih-juhn)* - An invisible, odorless gas that is needed by living things. Oxygen combines with hydrogen to form water.

pesticide *(PEHS-tuh-syd)* - Chemical used to kill pests, especially weeds and unwanted insects.

pollute *(puh-LOOT)* - To spoil the air, water or soil by adding harmful substances.

runoff *(RUHN-awf)* - Water from rain or melting ice and snow, that does not soak into the earth. It drains off the surface into nearby waterways.

sewage *(SOO-ij)* - Waste water that is carried away, usually by underground pipes and drains. It must be treated before being used again.

snow *(sno)* - Frozen water vapor in the air, usually falling in the form of small, white flakes or crystals.

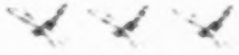
soil *(soyl)* - The ground in which plants grow. Soil includes materials that come from rock (sand, silt, clay), decaying plant and animal material, water, air and living organisms.

steam *(steem)* - The gas or vapor into which water is changed by boiling. Steam is water in the form of a gas.

urine *(YOOR-in)* - A liquid containing body wastes. Urine is released by the kidneys, stored in the bladder, and then discharged from the body.

vegetarian *(vehj-uh-TEHR-ee-uhn)* - One who eats grains, vegetables, fruits, and no meat.

wetland *(WEHT-land)* - Land that is covered with shallow salt or fresh water for all or part of the year. Marshes, swamps and bogs are kinds of wetlands.



The authors of this story – Barbara Tharp, Judith Dresden and Nancy Moreno – are faculty members in the Division of School-Based Programs at Baylor College of Medicine in Houston, Texas. They have been working together at Baylor for several years on science education projects involving teachers and students from kindergarten through college. All are parents of teenage or grown children. As a team, they also created instructional materials for the *BrainLink* project, which served as a model for the My Health My World project.

- Barbara Tharp, originally from California, once worked for the FBI in Washington, D.C., and later was an economic analyst for an oil company. More recently, she has been an elementary teacher specializing in her favorite subjects, science and math. Currently, in addition to creating educational materials, she enjoys working with many classroom teachers and their students.

- Judith Dresden, originally from New York and New England, formerly conducted educational research and evaluation for public and private schools. Editorial work with a publishing company also led to her current interest in writing and editing stories and science activities for children. Other projects involve promoting minority students' access to careers in science and the health professions.

- Nancy Moreno, originally from Wisconsin and Michigan, is a biologist who specializes in botany. She spent considerable time studying neotropical plants in Mexico before completing her doctoral degree at Rice University. Several current projects involve scientists in the education of elementary students and teachers. The My Health My World project builds upon her special interests in ecology and environmental issues.

The illustrator, T Lewis, was born in Texas but has traveled extensively, living in such locales as Africa, Switzerland and Alaska. Currently, he lives in a small town in the state of Washington where he and his wife are raising their young son. While his broad range of professional artwork has appeared in many formats, T Lewis is especially fond of creating illustrations for children. Recent books bearing his work are *Bedtime Rhymes from Around the World* and *Cinderella: The Untold Story*. He has drawn the Mickey Mouse comic strip for Disney Productions, as well as the comic, *Over the Hedge*, which recently attained national syndication. Prior to illustrating this and other My Health My World publications, T illustrated the stories in Baylor's *BrainLink* series.

WOW
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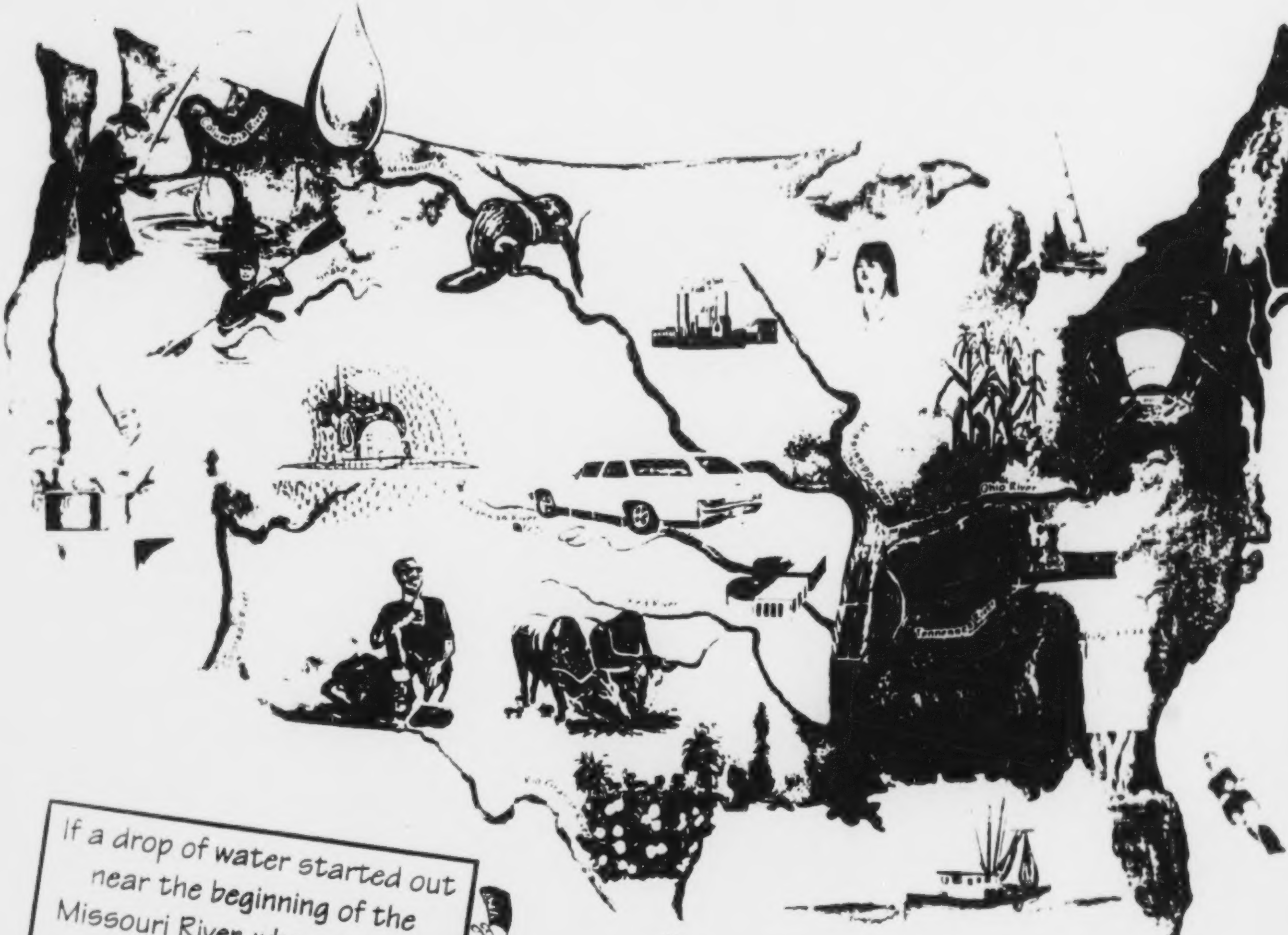
MY HEALTH MY WORLD
WATER AND MY WORLD

EXPLORATIONS

FOR CHILDREN AND ADULTS


Columbia River
Missouri River
Snake R.
Mississippi River
Ohio River
Tennessee River

If a drop of water started out near the beginning of the Missouri River, where might it go and how might it be used?

How many different uses of water can you find in this picture?
How many of these uses help you stay healthy?

Let's Talk *about...* W

Water Is Remarkable! Water is one of the most amazing substances on our planet. Did you know that every single living thing needs water? It is in each of the cells in our bodies and in the bodies of all plants, animals and other creatures.

Water is special because it can mix with many different liquids and solids. Its ability to stay warm for a long time makes it special too. This helps keep the temperature inside our bodies around 98° Fahrenheit. It also helps keep the temperature in oceans, lakes and rivers from changing very quickly.

Water can be polluted easily because so many different substances will dissolve in it. Can you think of any things that seem to disappear when you mix them with water?

Where Does Our Drinking Water Come From? Each of us uses water every day. Have you ever thought about where the water you use comes from? Even though most of us get our water from faucets, that is only the end of its journey.

About half of the drinking water used in the United States comes from lakes and rivers. The other half comes from springs and wells that reach water located deep underground. Much of this water has to be treated to make it safe to drink. Chlorine, for example, is added to water in most places to kill germs that can make us sick.

In an emergency, you can make most water safe to drink by boiling it for at least 10 minutes in a shallow pan.

Each One of Us Can Do Something. Sometimes, without knowing, we do things that harm our water supplies. When we use too much fertilizer or pesticide on lawns, gardens or fields, some of it can end up being washed into rivers and lakes. Once there, it can hurt fish and other animals. It also can make water unsafe for us to drink. Harmful chemicals can soak deep into the ground and pollute water that is found there. Even things like old paint or motor oil can be harmful if you dump them down

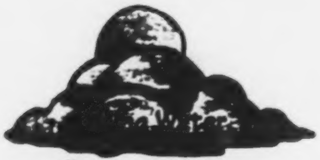
It floats! It floats!

The solid form of water, known as ice, floats. Have you ever thought about what would happen to the plants and animals that live in lakes and streams, if ice formed on the bottom instead of floating on the top?

ter and Health

the drain or pour them onto the ground. In the end, these things find their ways back into our water.

Why Is Clean Water Important? Water is used in many ways. We need clean drinking water to stay healthy. Water also is important for many other things that we need. Farms need water to produce crops and livestock. Factories need water to make many products. Water is used in power plants that make electricity. Since we all use water in so many ways, we should remember to take care of our water sources.



Drops on dogs,
On frogs and logs—
Drip–Drip–Drip,
They turn and flip.

They roll and patter,
Slip and splatter—
Drops on dogs
And frogs and logs.

Drip–Drip–Drip,
They turn and flip—
Drops on noses,
Heads and toeses.

Drops on dogs,
On frogs and logs,
And even on
The polywogs—

Rain is coming
Down on me,
And all the world
That I can see!

Tips for Healthy Living

You can help save water and keep our water supplies clean!

Use very little chemical fertilizer in your yard or garden — or even better. learn to build a compost pile and make your own fertilizer.

Don't waste water. Take short showers and don't leave the water running while you brush your teeth or wash your hands.

Take used motor oil to a gas station for recycling.

Repair water leaks and dripping faucets.

Save paper. plastics. aluminum products and glass for recycling. Reusing these materials helps save water and reduce water pollution.

Plant grass and other plants on hills to prevent erosion and help water sink into the soil.

If you think your water is polluted. call your city. county or state health department. For additional information. call the Environmental Protection Agency's Safe Drinking Water Hotline at (800) 426-4791.

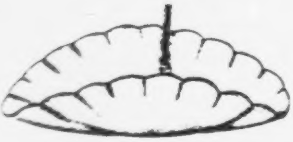
The Great Dissolver

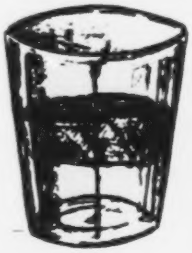
Water makes up 67% of the human body. It is the largest part of all living materials. Water is needed for the breakdown and movement of food in whole organisms and in each tiny cell. Most of the substances needed inside the body are carried in water.

Let's see how water helps things go through ...

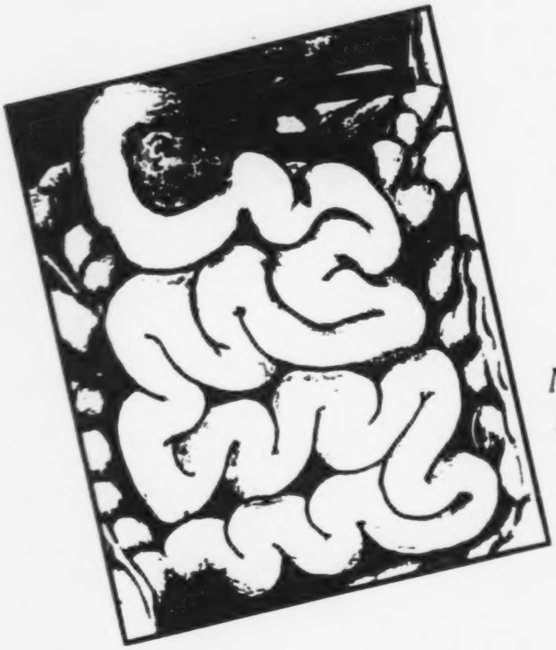
SOFT DRINK
MIX

1. Fold a round, pleated coffee filter in half. Open it up and sprinkle about a teaspoon of soft drink mix along the fold, stopping 5 cm from the edge of the line on each side.
2. Fold the filter in half, and then roll it to form a tube with the soft drink mix inside.
3. Clip the ends of the tube together, making a circle.
4. Place the paper circle in an empty glass and observe. What happened?
5. Now place the paper circle in a half cup of water and observe. What happened?





Place several dried beans in another filter paper tube. Without water, what happens? Place the tube with the beans in a half cup of water. What do you predict will happen?

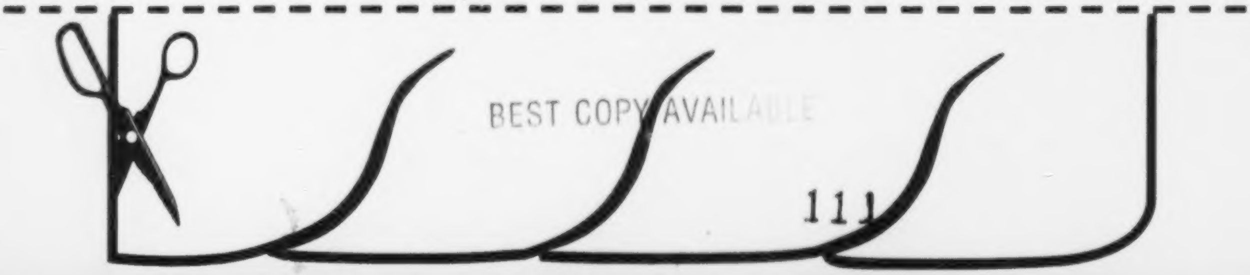


Most food is taken into the body through the small intestine. It is about 23 feet long. Can you find the path through the small intestine?

Try This!

Most water is taken into the body through the large intestine. Cut out 10 of these and tape them together to see how long your large intestine really is!

Fold your paper in half and lay this side along the fold.



What Am I?

To solve this double puzzle:

1. Read the riddle on the left, and fill in the answer to 'What am I?' at the end
2. Now match each line of the riddle to blue word on the right. Draw a line to the best word for each one. (The first line has been done for you.)

I run down hill and turn around.
I bubble up from underground.
I fall through air as rain or snow.
Then disappear in warm sun's glow.
I'm home for birds and plants and fish.
I rise above a boiling dish.
I wave and crash upon the shore.
I move the riverbank, and more.
I hang in air close to the seas.
And I get bigger when I freeze.

steam
ice
river
fog
precipitation
marsh
evaporation
spring
erosion
ocean

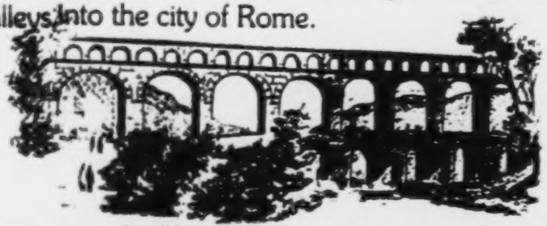
You'll find me in each living cell.
I must be clean, so you'll stay well!

What am I?

Not such a new issue...

In 1855, Dr. John Snow, an Englishman, figured out that water can carry germs that make people sick. Eventually, people learned that sewage and waste waters had to be cleaned before they could be put back into rivers and lakes.

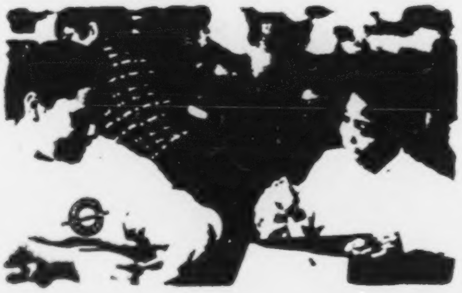
Cities always have needed a lot of water. About 2000 years ago, the Romans solved this problem by building a system of large pipes called aqueducts. The aqueducts carried water underground and over valleys into the city of Rome.



Vetruvius, a builder in ancient Rome, thought that pipes and dishes made out of lead could make water unsafe to drink. He was right!

We Can Make a Difference!

We are students from Anson Jones Elementary School and Robert Louis Stevenson Elementary School in Houston, Texas. We are learning about ways to keep our water supplies clean and save water too. We all need clean water to stay healthy.



At Stevenson Elementary, we are testing a sample of water for dissolved oxygen. The plants and animals in water need oxygen to survive. Polluted water sometimes doesn't have enough oxygen.

We work with the Texas Watch Program. We take samples of water from nearby rivers and test it for oxygen and some kinds of pollution. We also measure the temperature of the water.

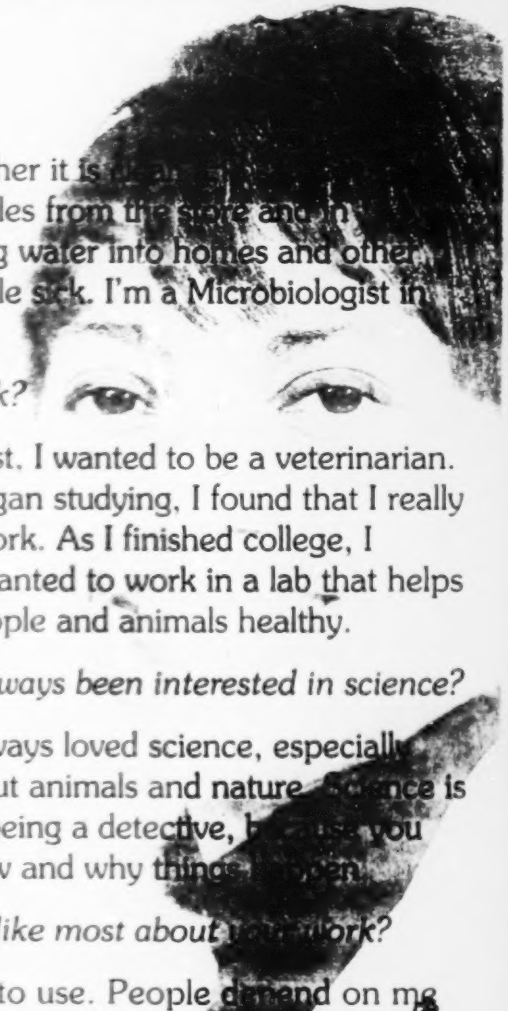
At Anson Jones Elementary, we are learning to save water in our garden. We used native plants that don't need to be watered every day. We also made our own fertilizer by composting.

Here, we are turning leaves in our compost bin. When the leaves rot, they will make a rich fertilizer that we can put on our garden. Adding compost helps the soil hold more water.

The Texas Watch program gives kids a chance to learn about water pollution and to help do something about it. There are over 2,500 teacher and student volunteers in Texas Watch. Most states have programs like Texas Watch. You and your teacher can call the Association of State Drinking Water Administrators at (202) 293-7655 and find out what's happening in your part of the country.

Rosie and Riff talk to...

Ms. Linda Holman



Ms. Holman, what do you do?

I test water from lakes and streams to see whether it is clean and [illegible] people to use. Sometimes I also test the water in bottles from the store and in vending machines, or in the wells and pipes that bring water into homes and other buildings. I look for tiny germs that might make people sick. I'm a Microbiologist in the City of Houston public health laboratory.

How did you decide to do this kind of work?

At first, I wanted to be a veterinarian. When I began studying, I found that I really liked lab work. As I finished college, I decided I wanted to work in a lab that helps to keep people and animals healthy.

Have you always been interested in science?

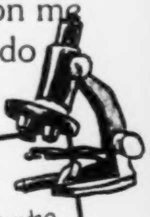
Yes, I've always loved science, especially learning about animals and nature. Science is fun! It's like being a detective, because you figure out how and why things happen.

What do you like most about your work?

My work helps make water safe for everyone to use. People depend on me to work carefully. I really enjoy doing that. I feel good about knowing I can do something well.

Is there anything else you would like to tell our readers?

Science is exciting, but it's important to learn about all the other subjects in school too. A good scientist needs to know about language, math and social studies as well as science. Another important thing to remember is to be patient. Don't give up, but just keep on trying until it works out.



What is a microbiologist?

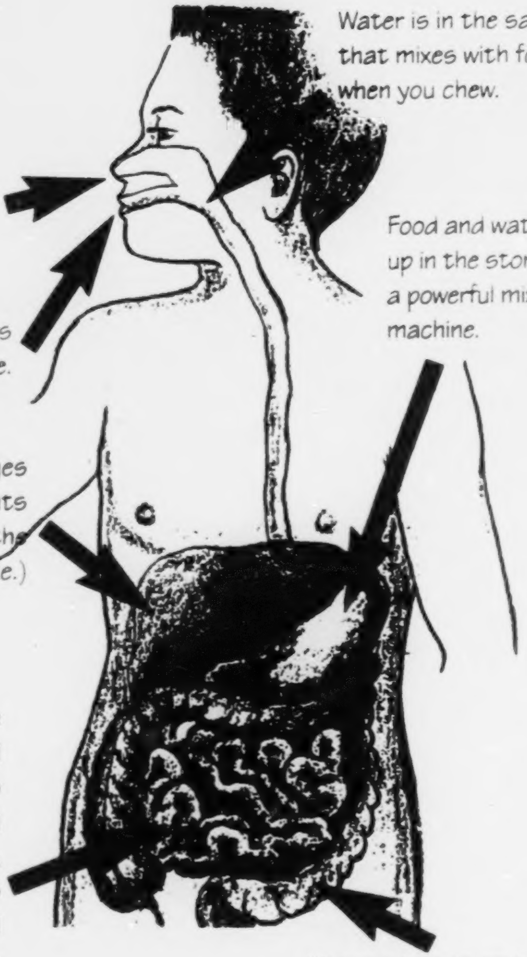
A microbiologist is a kind of scientist who studies very tiny living things—so tiny, in fact, that they only can be seen by using a microscope. "Micro-" comes from a Greek word that means very small. What other words do you know that start with micro?

Water in Your Body

Can you find all the ways your body uses water?

The kidneys manage water in the body and filter wastes out of the blood.

Wastes are mixed with water to form urine. Urine drains out of the kidneys and collects in the bladder until you get rid of it.



Water is in the saliva that mixes with food when you chew.

Water vapor goes in and out here

Most water comes in here.

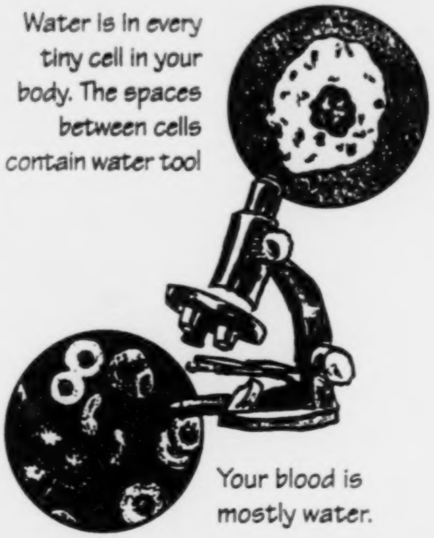
Food and water end up in the stomach—a powerful mixing machine.

(The liver manages most nutrients that come from the small intestine.)

From the stomach, mixed food and water go into the small intestine. Here, food is broken up into small molecules that can enter the bloodstream.

Water, minerals and some vitamins are taken up in the large intestine. Food that isn't digested collects here too.

Water is in every tiny cell in your body. The spaces between cells contain water too!



Your blood is mostly water.

Water is in perspiration and in tears.

When you sweat, your body is losing water. Don't forget to drink water, especially when it's hot!

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